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CURRENT METER AND TIDE GAUGE OBSERVATIONS FROM AVALON CHANNEL, 1980-1981

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ABSTRACT

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Statistics of current speed and direction, temperature, salinity and bottom pressure are presented for an array of current meters, thermistor chains and tide gauges located in the Avalon Channel off the east coast of Newfoundland. The statistics include means, extrema and standard deviations of the basic and low-pass filtered data series. Time series plots, progressive vector diagrams, stick plots, autospectra and tidal analyses are also presented.

RÉSUMÉ

Petrie, Brian. 1991. Current meter and tide gauge observations from Avalon Channel, 1980-1981. Can. Data Rep. Hydrogr. Ocean Sci. No. 102: v + 99 pp.

On présente des statistiques sur la vitesse et la direction des courants, ainsi que sur leur température, salinité et pression de fond. Elles proviennent d'une batterie de courantomètres, de chaines de thermistances et de marégraphes mouillés dans le chenal d'Avalon, au large de la côte est de Terre-Neuve. Ces statistiques comportent notamment les moyennes, extrémes et écarts-types de séries de données de base et de données de filtrage passe-bas, ainsi que des représentations graphiques de séries chronologiques, des diagrammes vectoriels progressifs, des schémas squelettisés, des autospectres et des analyses de la marée.

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Introduction

The work of Sutcliffe et al. (1976) has indicated the importance of freshwater input onto the continental shelves of eastern Canada. For the Newfoundland Shelf in particular, Bailey (1961) and Huyer and Verney (1975) have related the annual appearance of fresher water at St. John's in late summer to the spring runoff in the Arctic and Labrador regions. Their work has been updated in recent papers by Myers et al. (1990) and Petrie et al. (1991, 1992) who discuss the above mechanisms and the influence of ice melt. Akenhead et al. (1981) connected the annual variability of coastal sea level at St. John's and Nain to the variation of water properties on the shelf. In particular, they showed that the rapid increase of sea level to its highest values in the late summer and fall at St. John's corresponded to the arrival of fresher water; moreover, the difference in arrival times at the two tide gauge sites could be used to provide an overall estimate of current speed. Petrie et al. (1991) refined these calculations and, in addition, made an estimate of the vertical exchanges.

In 1980 the Department of Fisheries and Oceans (DFO) deployed a current meter array in the Avalon Channel as part of an investigation of the circulation off the east coast of Newfoundland (Fig. 1). The principal objectives of the project were:

1) a review of the oceanographic data for the Newfoundland Shelf area in order to describe the mean circulation and indicate the regions where our knowledge was most lacking. An analysis of existing data was presented by Petrie and Anderson (1983).

2) an investigation of the changes of the circulation of the inshore branch of the Labrador Current which may occur with the passage of the fresher water pulse.

3) an examination of the wind-forced dynamics of the coastal currents in the Channel. These latter two objectives were addressed as part of the thesis of Anderson (1986).

4) a study to determine the effectiveness of observations of sea level, bottom pressure and hydrographic conditions in monitoring the flow and variability of the inshore branch of the Labrador Current. Hydrographic measurements collected during the project have been reported by Lively (1983).

The current meter data collected during the Avalon Channel mooring program are presented in this report.

Mooring Locations and Data Return

The oceanographic measurements made in Avalon Channel were the work of two groups within DFO. A water level survey was conducted by the Tidal Section of the Canadian Hydrographic Service; the current meter and hydrographic programs were carried out by the Atlantic Oceanographic Laboratory (now the Physical and Chemical Sciences Branch (PCS)). The project began in May, 1979 when a tide gauge mooring was set in Avalon Channel as part of the water level survey. This mooring was replaced in September and the following January. The main Avalon Channel array (PCS moorings 393-396, Fig. 2) of tide gauges, current meters and thermistor chains was set in June, 1980 and was recovered in October of the same year. One current meter string (429) was maintained

over the winter at the same position as mooring 393. It was recovered in late April, 1981. The data from the PCS mooring array are presented in this report.

A summary of the mooring depths and positions for both programs is shown in Table 1. The September to January tide gauge, which did not record any usable data, is not included. The data returns for each instrument are presented in Table 2.

Data Processing

Initial data processing was carried out by the Coastal Oceanography data group. A Cartwright low-pass filter which passes 50% of the power at 31.25h has been used to produce the time series with a 6h sampling interval that are shown in the report. This filter effectively removes semi-diurnal and diurnal tidal, and inertial period energy from the raw data series. Harmonic analysis was used to compute tidal amplitudes and phases. More details of the filtering and analysis techniques can be found in Lively (1988).

Data Presentation and Discussion

The mean currents (Fig. 3, 4) in plan and alongshore cross-sectional views show that all average flows are directed southward with the strongest occurring closest to the coast at mooring 393. The currents at mooring 394 have a significant onshore component, an observation reproduced by the barotropic circulation model of Greenberg and Petrie (1988). Farther offshore at site 395, the flows are again aligned generally in the north-south direction, a feature also found for the principal axes of variance for sub-tidal motion at all sites.

The tidal constants for currents and pressure from all mooring sites were determined by harmonic analysis and are presented in Table 3. Values are given for the M_2, N_2, S_2, K_1 and O_1 constituents. The tables of tidal constants are followed by a set of basic statistics and plots for each instrument. The statistics include the means, extrema and standard deviations of all variables for the raw and low-passed data series. The figures include progressive vector diagrams, time series plots and autospectra. The data products are presented for mooring 393 first, followed by 394, 395, 429 and finally for the pressure time series from 393, 394 and 396. The autospectra of the U and V components of current, positive eastward and northward respectively, temperature and salinity are scaled relative to their peak amplitudes which should be remembered in any intercomparisons of plots.

There are some interesting features in the data time series that are worthwhile noting. At approximately day 230 there is a significant change in the hydrographic properties, for example, at mooring 393, 30m, the temperature increases substantially and becomes less variable. At the same time the salinity decreases and continues to decline slowly with reduced variance. The timing coincides with that expected for the arrival of the freshwater pulse. The temperature changes are reflected at deeper levels as shown by the thermistor chain data from the same mooring. As depth increases the abruptness of the transition to warmer temperatures decreases; in addition, there appears to be a phase lag. The T and S changes are also detected at the moorings farther offshore (see 394, 29m and 395, 30m e. g.).

There is not compelling evidence for corresponding changes in the sub-tidal currents in any of the records. However, there does appear to be a sharp increase in inertial period energy associated with the change of the

hydrographic properties, particularly at the shallowest sensors on moorings 394 and 395. A large perturbation (30 mbar) of the bottom pressure is seen at all 3 tide gauges, beginning on day 230 and lasting for about 2d. A similar perturbation occurred about 20d later with corresponding fluctuations observed at the two inner moorings in temperature and velocity.

The single mooring, 429, that was maintained over the winter shows a gradual increase of salinity at 38m from November to April. Temperature reaches minimum values in late February and early March.

Acknowledgements

I thank R. Lively for his assistance preparing the data for analysis. During recovery operations for the remains of mooring 396, P. d'Entremont was very helpful and instrumental in the success of obtaining the tide gauge and release by dragging. A. Clarke took time out of his cruise to recover mooring 429. K. Drinkwater and D. Lawrence made useful comments on the manuscript.

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TABLE 1

AVALON CHANNEL MOORINGS

STATION	LATITUDE (N)	LONGITUDE (W)	SOUNDING (m)	INSTRUMENT TYPE	INSTRUMENT DEPTH	START	DURATION DAYS
1	47 00.6	51 35.4	102	TG	102	23/05/79	117
3	47 00.6	51 34.8	98	TG	98	09/01/80	164
393	47 30.06	52 34.96	175	CM	30	21/06/80	124
				CM	80	21/06/80	124
				CM	130	21/06/80	124
				TC	25-80	21/06/80	124
				TG	174	22/06/80	124
394	47 25.92	52 18.91	161	CM	29	21/06/80	124
				CM	54	21/06/80	124
				CM	104	21/06/80	124
				TG	160	22/06/80	124
395	47 21.45	52 00.07	164	CM	30	21/06/80	124
				CM	80	21/06/80	124
				CM	130	21/06/80	124
396	47 16.20	51 36.00	153	CM	29	21/06/80	-
				TC	29-119	21/06/80	-
				TG	152	22/06/80	124
429	47 30.06	52 34.96	175	CM	38	23/10/80	182
				CM	117	23/10/80	182
				TG	174	23/10/80	182

TG, CM and TC stand for tide gauge, current meter and thermistor chain, respectively.

TABLE 2

DATA RETURN

STATION	INSTRUMENT TYPE	DEPTH (m)	RATE	DIR	TEMP	COND	PRES
1	TG	102					X
3	TG	98					X
393	CM	30	X	X	X	X	
	CM	80	X	X	-	-	
	CM	130	X	X	X	X	
	TC	25, 35-75			X		
		30			-		
		80			-		
	TG	174			X		X
394	CM	29	X	X	X	X	
	CM	54	X	X	X	X	
	CM	104	X	X	X	X	
	TG	160			X		X
395	CM	30	X	X	X	X	
	CM	80	X	X	X	X	
	CM	130	X	X	-	-	
396	CM	29	Instrument lost				
	TC	29-119	Instrument lost				
	TG	152			X	X	
429	CM	38	X	X	X	X	
	CM	117	X	X	X	X	
	TG	174					X

X indicates a full data set, - indicates a sensor malfunction.

TABLE 3

TIDAL CONSTANTS

MOORING 393 DEPTH 30M

CONS	MAJOR AMPL (M/S)	PHASE LAG DEGREES GMT	DIR	MINOR AMPL (M/S)	PHASE LAG DEGREES GMT	ROT
M2	.094	60	6	.002	150	C
S2	.015	114	25	.003	24	A
N2	.015	59	0	.003	149	C
K1	.019	347	353	.003	257	A
O1	.028	299	358	.003	209	A

MOORING 393 DEPTH 80M

CONS	MAJOR AMPL (M/S)	PHASE LAG DEGREES GMT	DIR	MINOR AMPL (M/S)	PHASE LAG DEGREES GMT	ROT
M2	.081	61	4	.001	331	A
S2	.013	156	347	.000	66	A
N2	.016	57	23	.001	327	A
K1	.011	283	32	.002	13	C
O1	.018	263	5	.002	353	C

MOORING 393 DEPTH 130M

CONS	MAJOR AMPL (M/S)	PHASE LAG DEGREES GMT	DIR	MINOR AMPL (M/S)	PHASE LAG DEGREES GMT	ROT
M2	.081	58	4	.002	328	A
S2	.015	132	10	.001	42	A
N2	.013	29	22	.003	299	A
K1	.009	297	340	.000	27	C
O1	.015	278	358	.001	188	A

MOORING 394 DEPTH 29M

	MAJOR			MINOR		
CONS	AMPL (M/S)	PHASE LAG DEGREES GMT	DIR	AMPL (M/S)	PHASE LAG DEGREES GMT	ROT
M2	.080	60	20	.013	150	C
S2	.023	115	28	.010	205	C
N2	.014	63	350	.001	153	C
K1	.014	297	54	.001	27	C
O1	.020	285	14	.001	15	C

MOORING 394 DEPTH 54M

	MAJOR			MINOR		
CONS	AMPL (M/S)	PHASE LAG DEGREES GMT	DIR	AMPL (M/S)	PHASE LAG DEGREES GMT	ROT
M2	.078	61	21	.008	151	C
S2	.010	130	16	.000	40	A
N2	.020	24	42	.004	114	C
K1	.012	341	9	.006	71	C
O1	.015	292	2	.001	202	A

MOORING 394 DEPTH 104M

	MAJOR			MINOR		
CONS	AMPL (M/S)	PHASE LAG DEGREES GMT	DIR	AMPL (M/S)	PHASE LAG DEGREES GMT	ROT
M2	.081	62	21	.008	152	C
S2	.009	104	49	.003	14	A
N2	.011	26	40	.002	116	C
K1	.008	329	8	.001	59	C
O1	.014	287	353	.000	17	C

MOORING 395 DEPTH 30M

CONS	MAJOR AMPL (M/S)	PHASE LAG DEGREES GMT	DIR	MINOR AMPL (M/S)	PHASE LAG DEGREES GMT	ROT
M2	.064	72	35	.001	162	C
S2	.011	111	53	.001	21	A
N2	.014	24	58	.001	114	C
K1	.009	335	41	.005	245	A
O1	.013	295	26	.003	25	C

MOORING 395 DEPTH 80M

CONS	MAJOR AMPL (M/S)	PHASE LAG DEGREES GMT	DIR	MINOR AMPL (M/S)	PHASE LAG DEGREES GMT	ROT
M2	.075	81	38	.014	171	C
S2	.012	117	50	.002	27	A
N2	.014	55	42	.010	145	C
K1	.006	338	53	.000	248	A
O1	.012	294	38	.002	204	A

MOORING 395 DEPTH 130M

CONS	MAJOR AMPL (M/S)	PHASE LAG DEGREES GMT	DIR	MINOR AMPL (M/S)	PHASE LAG DEGREES GMT	ROT
M2	.068	78	32	.009	168	C
S2	.011	91	62	.003	1	A
N2	.016	58	25	.003	148	C
K1	.010	332	47	.001	62	C
O1	.012	306	25	.001	36	C

MOORING 429 DEPTH 38M

	MAJOR			MINOR		
CONS	AMPL (M/S)	PHASE LAG DEGREES GMT	DIR	AMPL (M/S)	PHASE LAG DEGREES GMT	ROT
M2	.077	125	1	.005	215	C
S2	.021	193	9	.001	283	C
N2	.017	121	1	.002	31	A
K1	.013	259	1	.005	349	C
O1	.030	327	348	.001	237	A

MOORING 429 DEPTH 117M

	MAJOR			MINOR		
CONS	AMPL (M/S)	PHASE LAG DEGREES GMT	DIR	AMPL (M/S)	PHASE LAG DEGREES GMT	ROT
M2	.074	107	5	.002	17	A
S2	.015	182	334	.001	92	A
N2	.013	86	10	.001	176	C
K1	.004	150	41	.002	240	C
O1	.027	290	8	.004	200	A

MOORING 393 DEPTH 174M

MOORING 394 DEPTH 161M

MOORING 396 DEPTH 152M

	393		394		396	
CONS	AMPL (MBAR)	PHASE LAG DEGREES GMT	AMPL (MBAR)	PHASE LAG DEGREES GMT	AMPL (MBAR)	PHASE LAG DEGREES GMT
M2	36.8	313	36.6	316	34.8	320
S2	14.0	351	13.8	353	13.3	354
N2	7.2	305	7.3	308	7.0	313
K1	8.7	153	8.5	154	8.0	153
O1	6.9	132	6.6	134	5.8	136

Figure 1. Location map for the Avalon Channel mooring array.

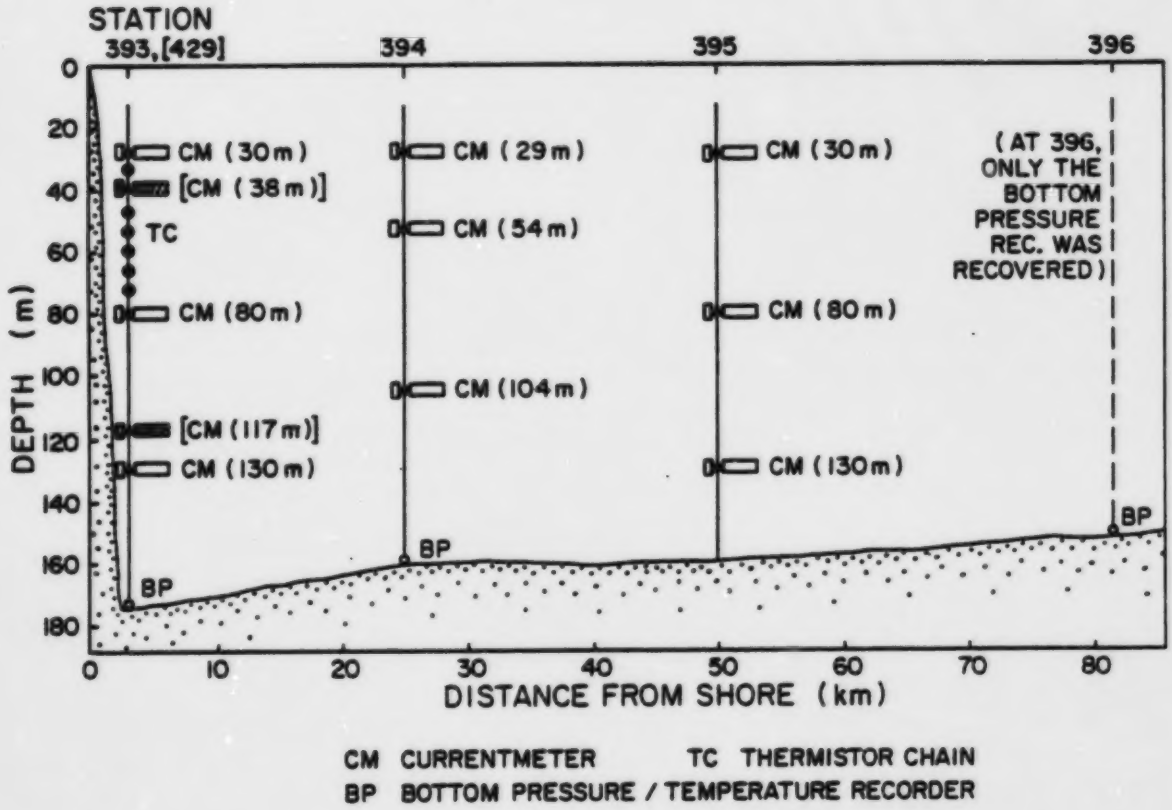


Figure 2. Cross-section of the Avalon Channel mooring array.

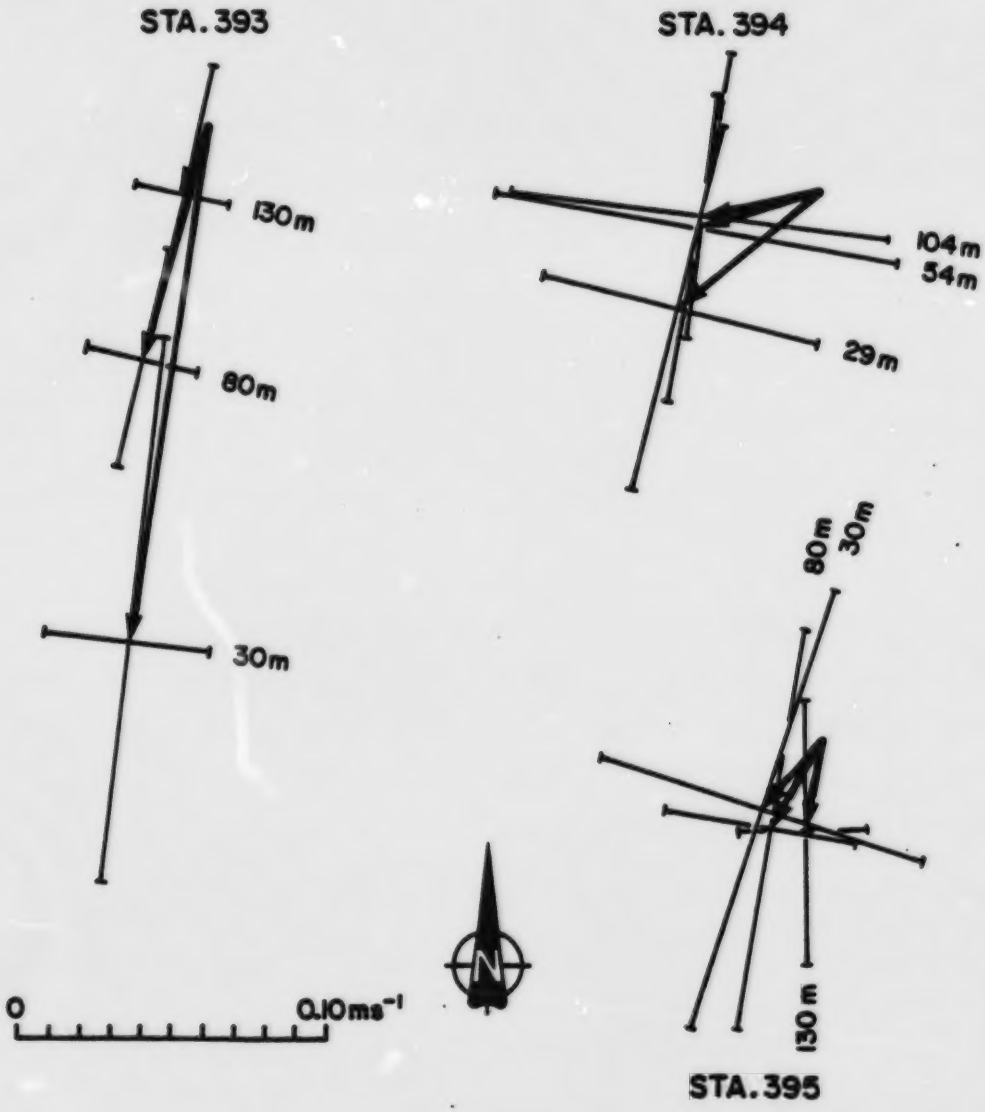


Figure 3. Mean currents and subtidal standard deviations resolved on the principal axes of variation at stations 393, 394 and 395 at the indicated depths.

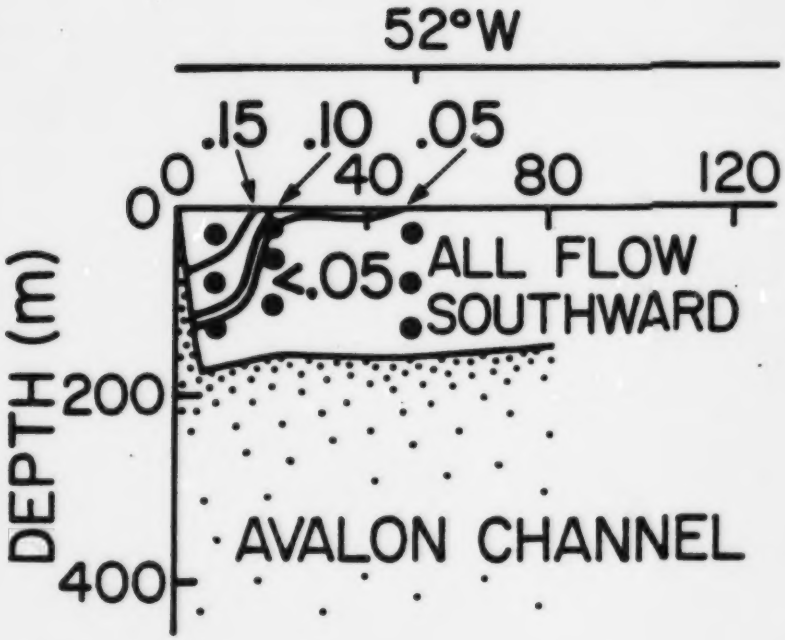


Figure 4. A cross-sectional view of the mean southward currents in Avalon Channel.

CURRENT METER STATISTICS

MOORING 393

DEPTH (M) 30

INSTRUMENT TYPE/SERIAL NUMBER	AANDERAA RCM4 816
LATITUDE	47 30.06 N
LONGITUDE	52 34.96 W
WATER DEPTH (M)	175
MOORING DATE/CRUISE	21/ 6/1980 80019
DURATION (DAYS)	123.7
SAMPLE INTERVAL (MINUTES)	30

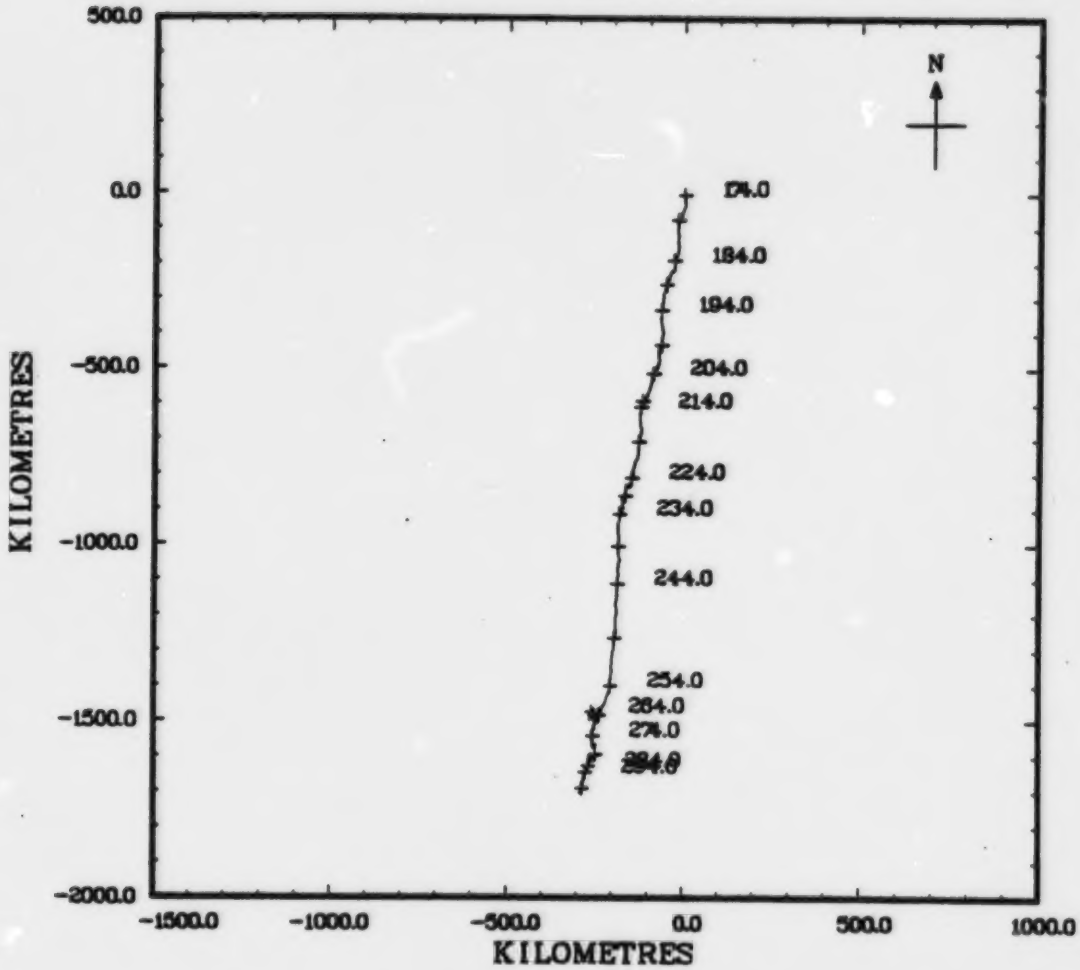
VARIABLE (UNITS)	MEAN	MIN	MAX	STD. DEV.	SAMPLES
E COMP VEL(M/S)	-.024	-.396	.318	.087	5937
N COMP VEL(M/S)	-.150	-.788	.602	.199	5937
TEMPERATURE (^{o}C)	7.52	.79	11.83	2.26	5937
SALINITY	31.51	30.79	32.60	.49	5937

LOW PASS FILTER SAMPLE INTERVAL 6H

	E VELOCITY	N VELOCITY	TEMPERATURE	SALINITY
MEAN	-.026	-.157	7.57	31.51
STD. DEV.	.045	.160	2.13	.47

COMMENTS

STN. 393, 30 M.



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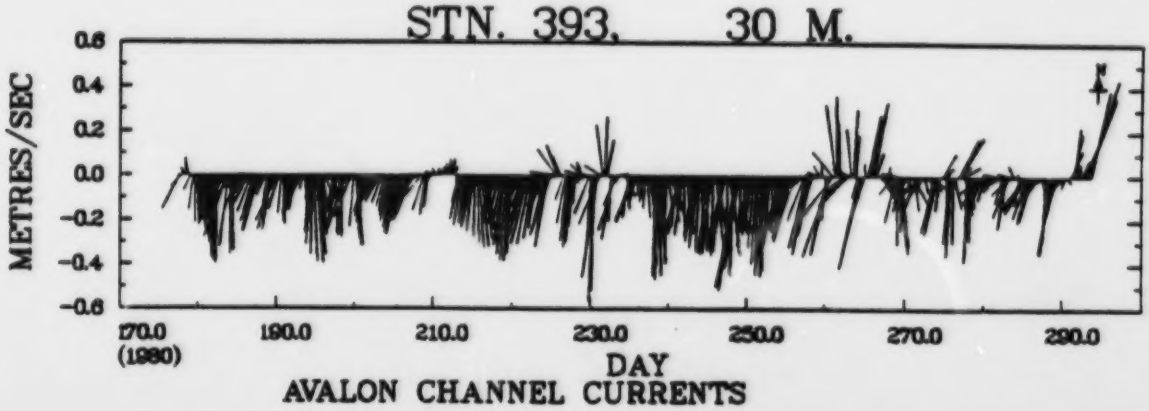
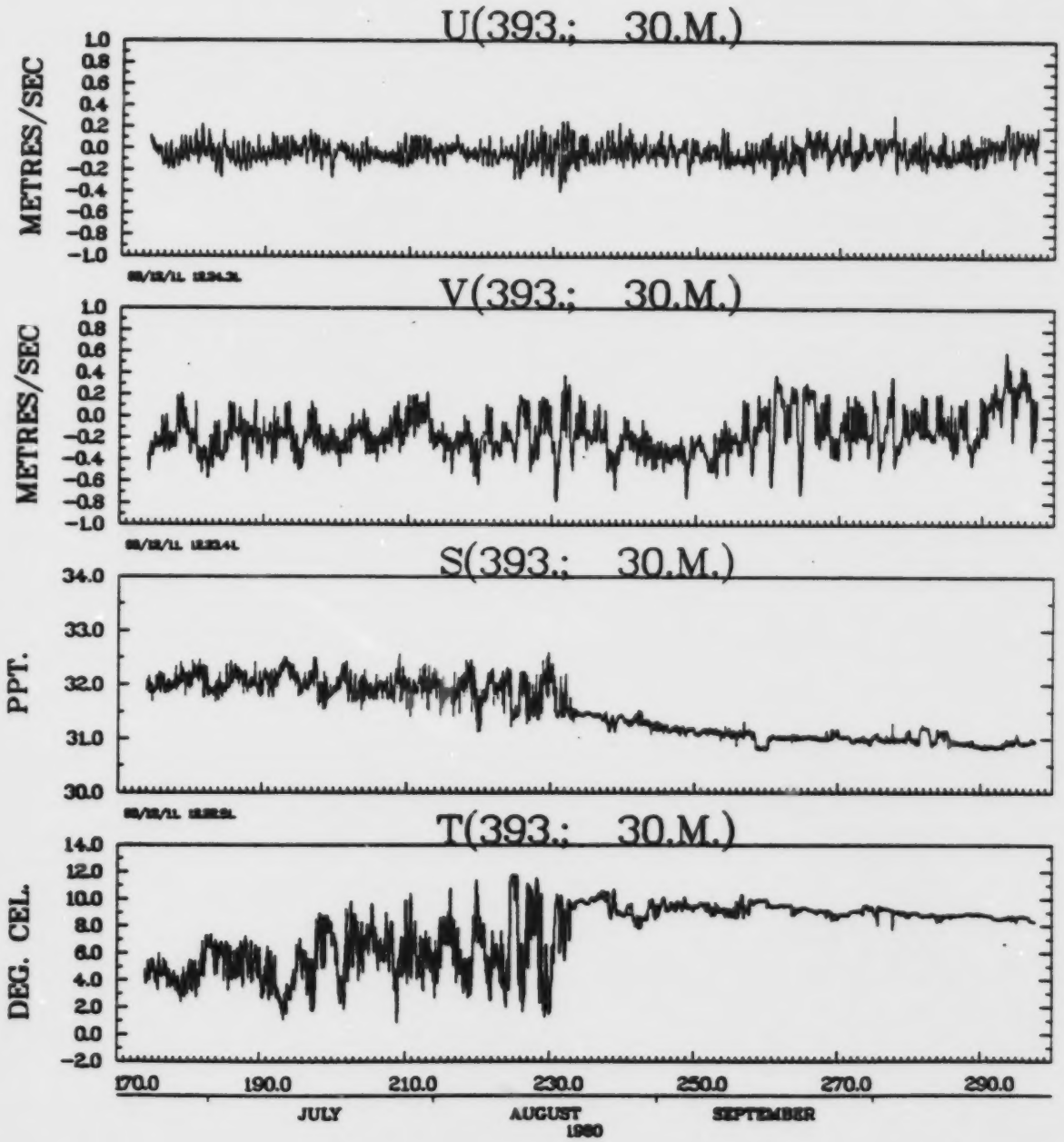
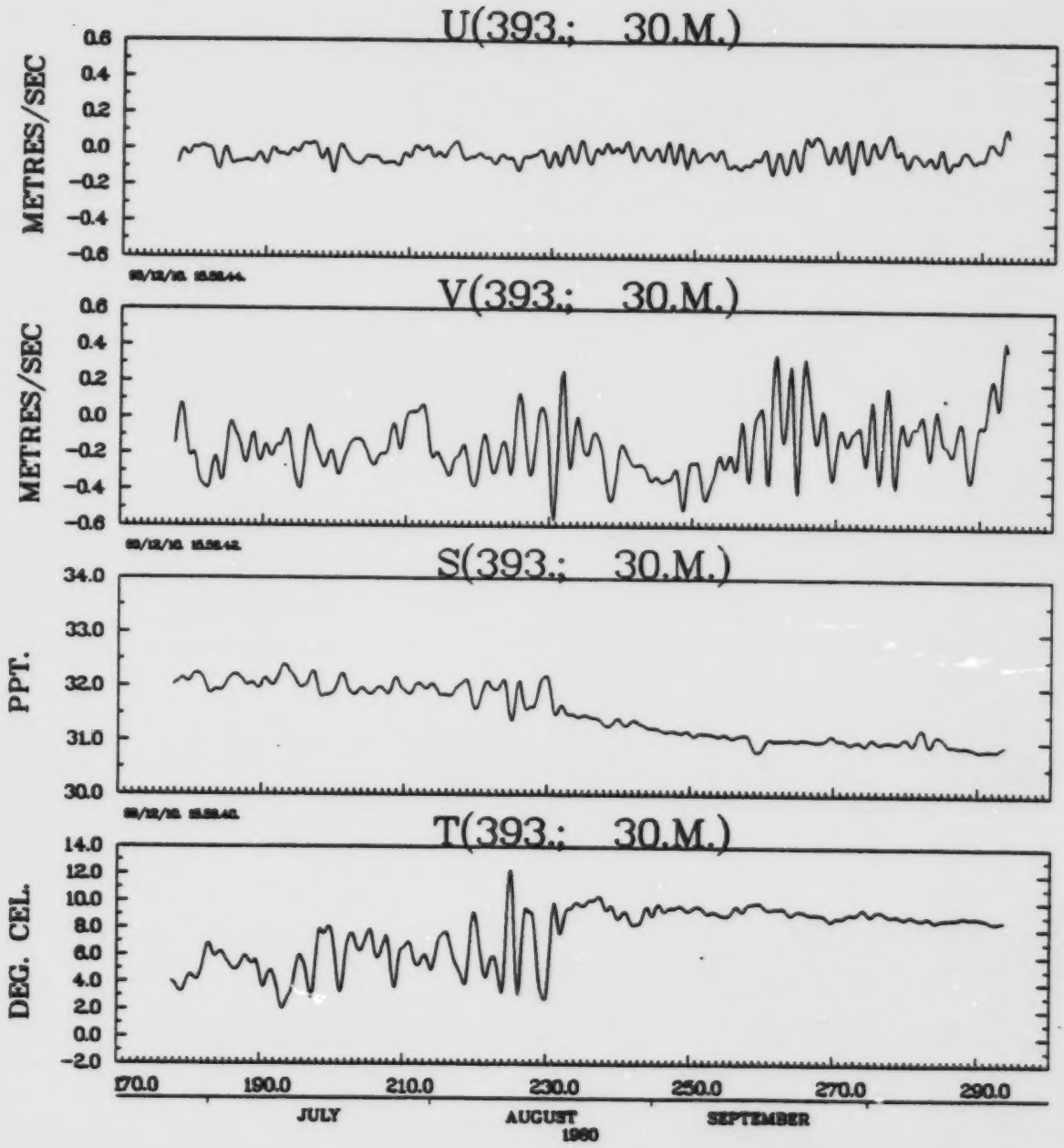


AVALON CHANNEL CURRENTS

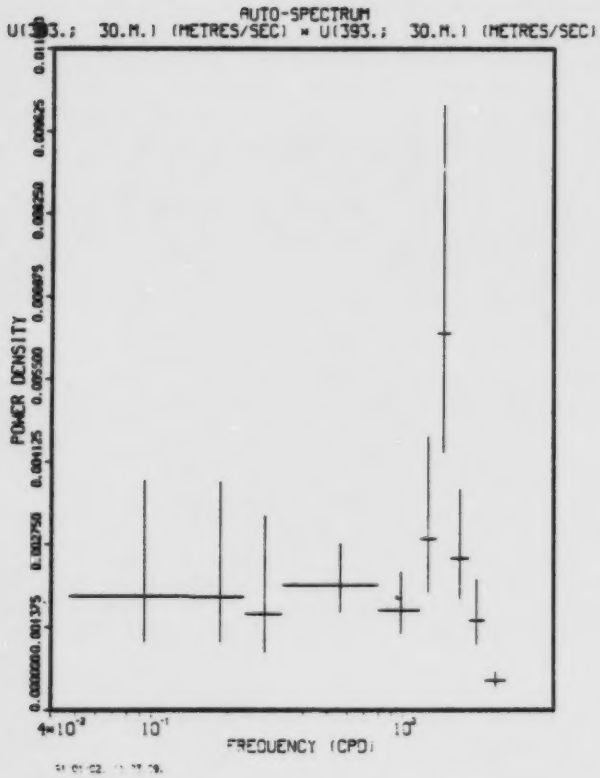


AP1(393.; 30.M.) AVALON CHANNEL JUNE 21–OCT.23/80

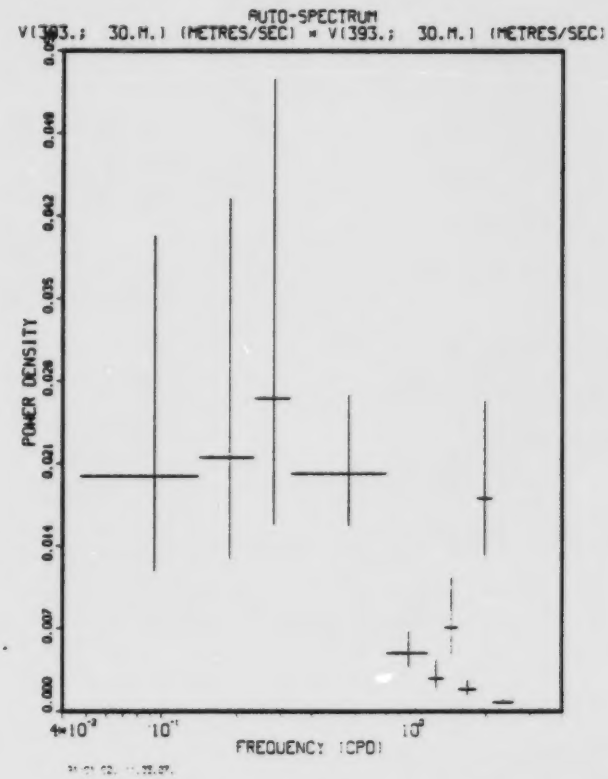


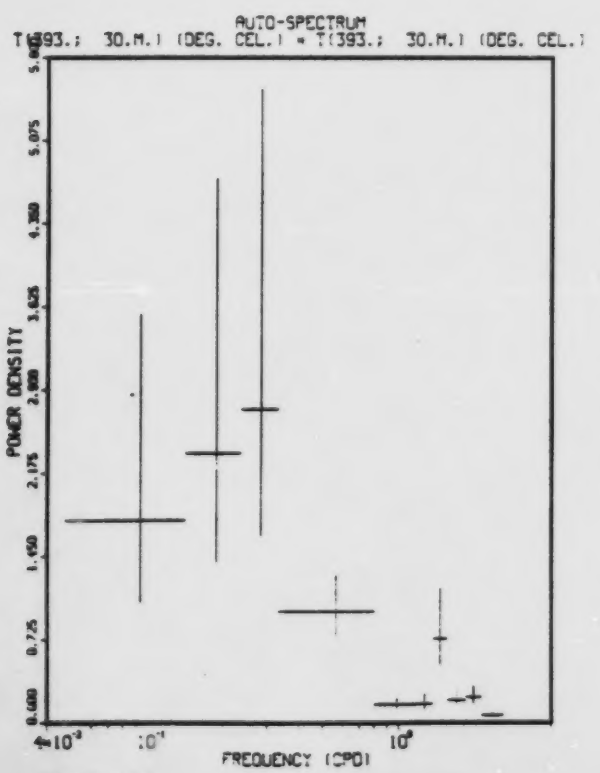
AP1(393.; 30.M.) AVALON CHANNEL JUNE 21-OCT.23/80

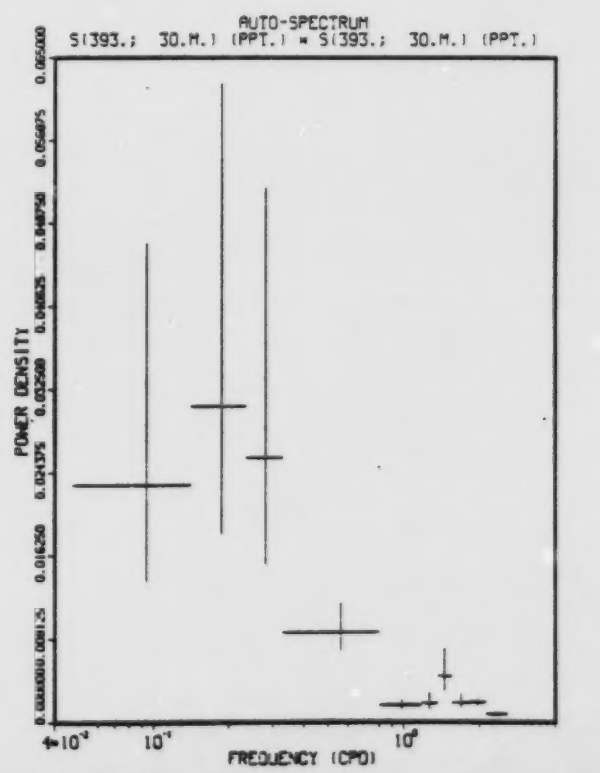
AP1 393.; 30.M.) AVALON CHANNEL JUNE 21-OCT.23/80



AP1(393.; 30.M.) AVALON CHANNEL JUNE 21-OCT.23/80







MOORING 393

DEPTH (M) 25 - 80

INSTRUMENT TYPE/SERIAL NUMBER	AANDERAA T-CHAIN 326
LATITUDE	47 30.06 N
LONGITUDE	52 34.96 W
WATER DEPTH (M)	175
MOORING DATE/CRUISE	21/ 6/1980 80019
DURATION (DAYS)	123.7
SAMPLE INTERVAL (MINUTES)/NUMBER	60/2968

VARIABLE (UNITS)	MEAN	MIN	MAX	STD. DEV.	DEPTH (M)
TEMPERATURE (^{o}C)	7.29	6.93	11.70	2.49	25
TEMPERATURE (^{o}C)	5.12	-.53	11.44	3.45	35
TEMPERATURE (^{o}C)	3.99	-.96	9.58	3.36	40
TEMPERATURE (^{o}C)	2.82	-1.10	9.51	2.99	45
TEMPERATURE (^{o}C)	1.74	-1.30	9.49	2.47	50
TEMPERATURE (^{o}C)	.91	-1.51	9.49	1.96	55
TEMPERATURE (^{o}C)	.27	-1.60	7.79	1.47	60
TEMPERATURE (^{o}C)	-.19	-1.62	6.15	1.10	65
TEMPERATURE (^{o}C)	-.48	-1.60	5.08	.83	70
TEMPERATURE (^{o}C)	-.70	-1.67	2.93	.68	75

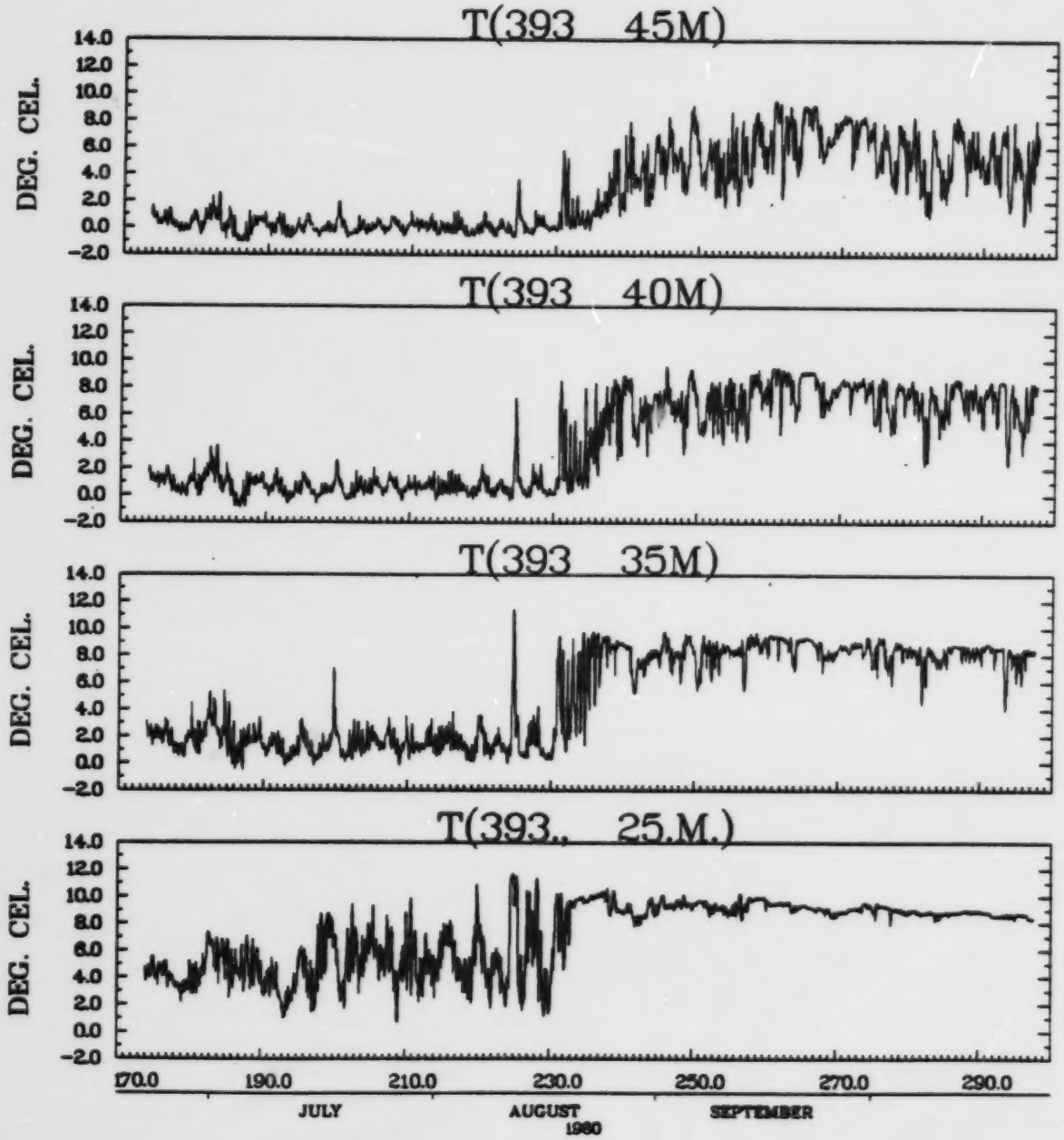
LOW PASS FILTER SAMPLE INTERVAL 6H

TEMPERATURE

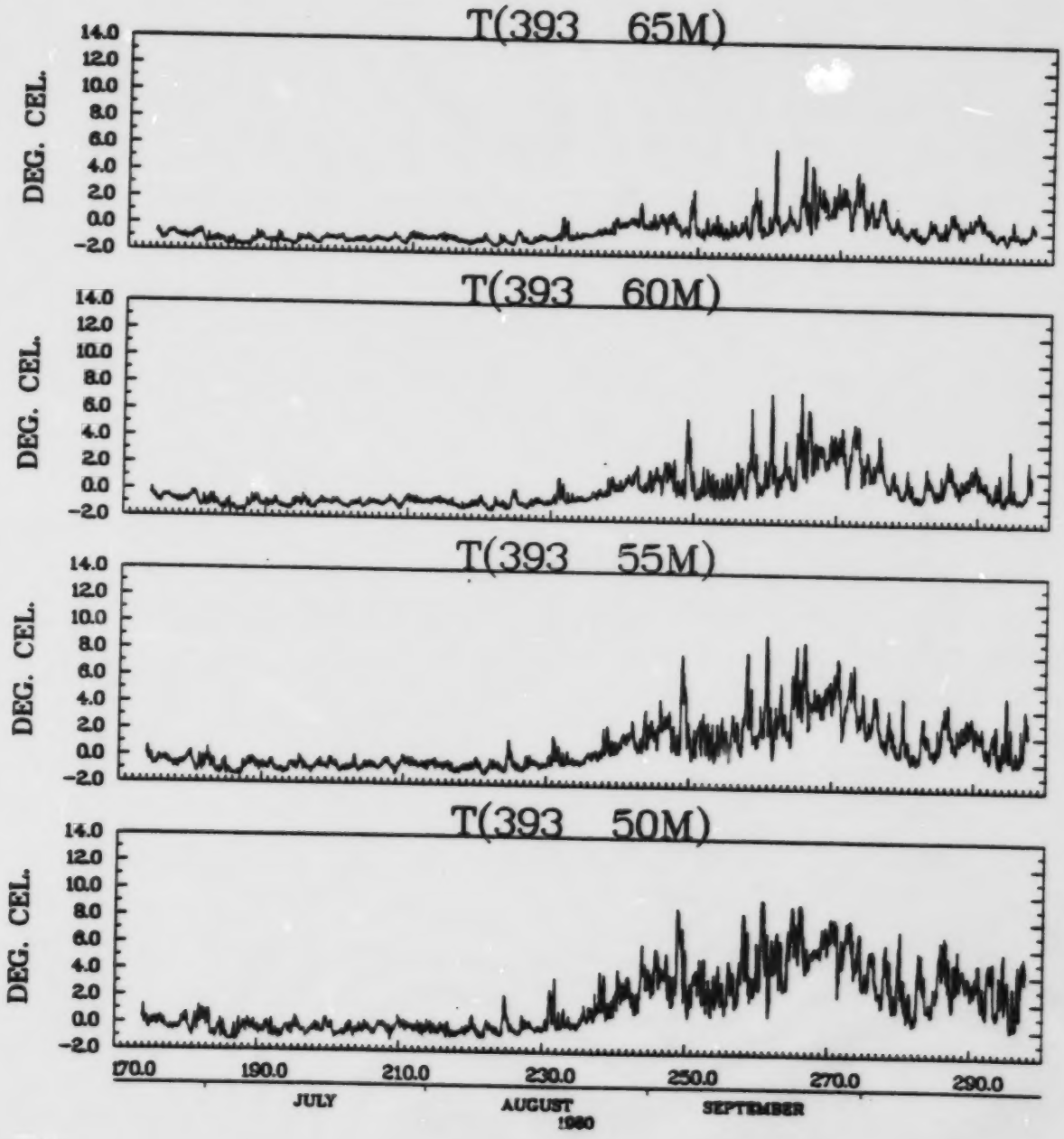
DEPTH (M)	25	35	40	45	50	55	60	65	70	75
MEAN	7.24	5.12	3.99	2.83	1.76	.93	.29	-.18	-.47	-.70
STD. DEV.	2.38	3.39	3.30	2.93	2.41	1.89	1.43	1.06	.80	.66

COMMENTS

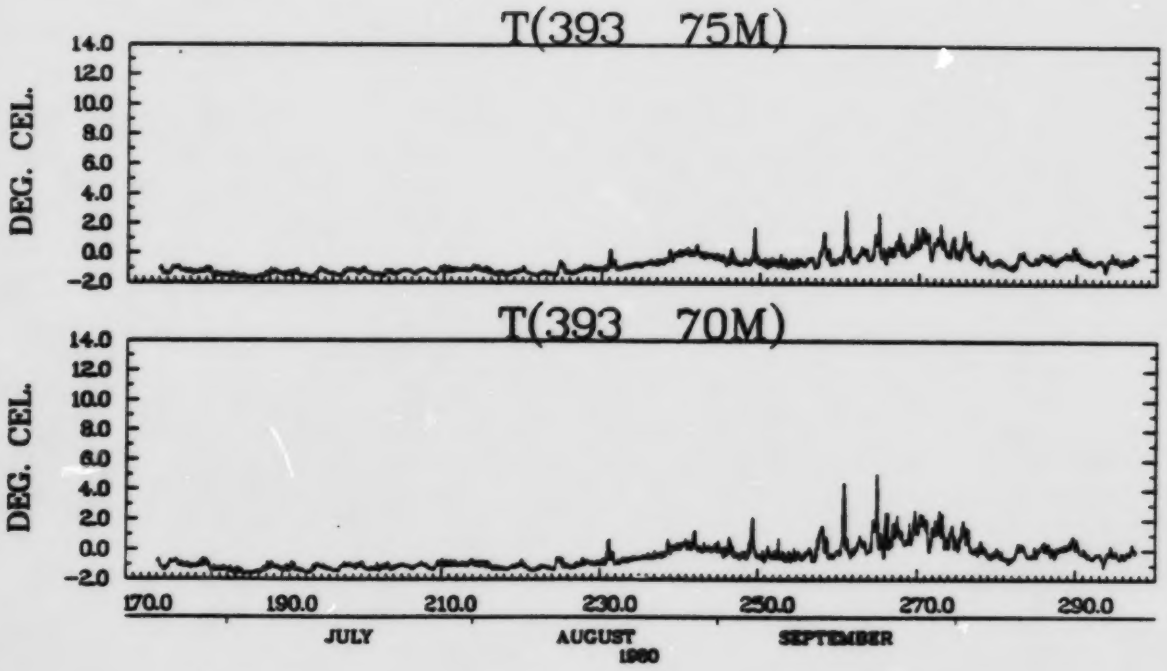
TEMPERATURE SENSORS AT 30 AND 80M FAILED.



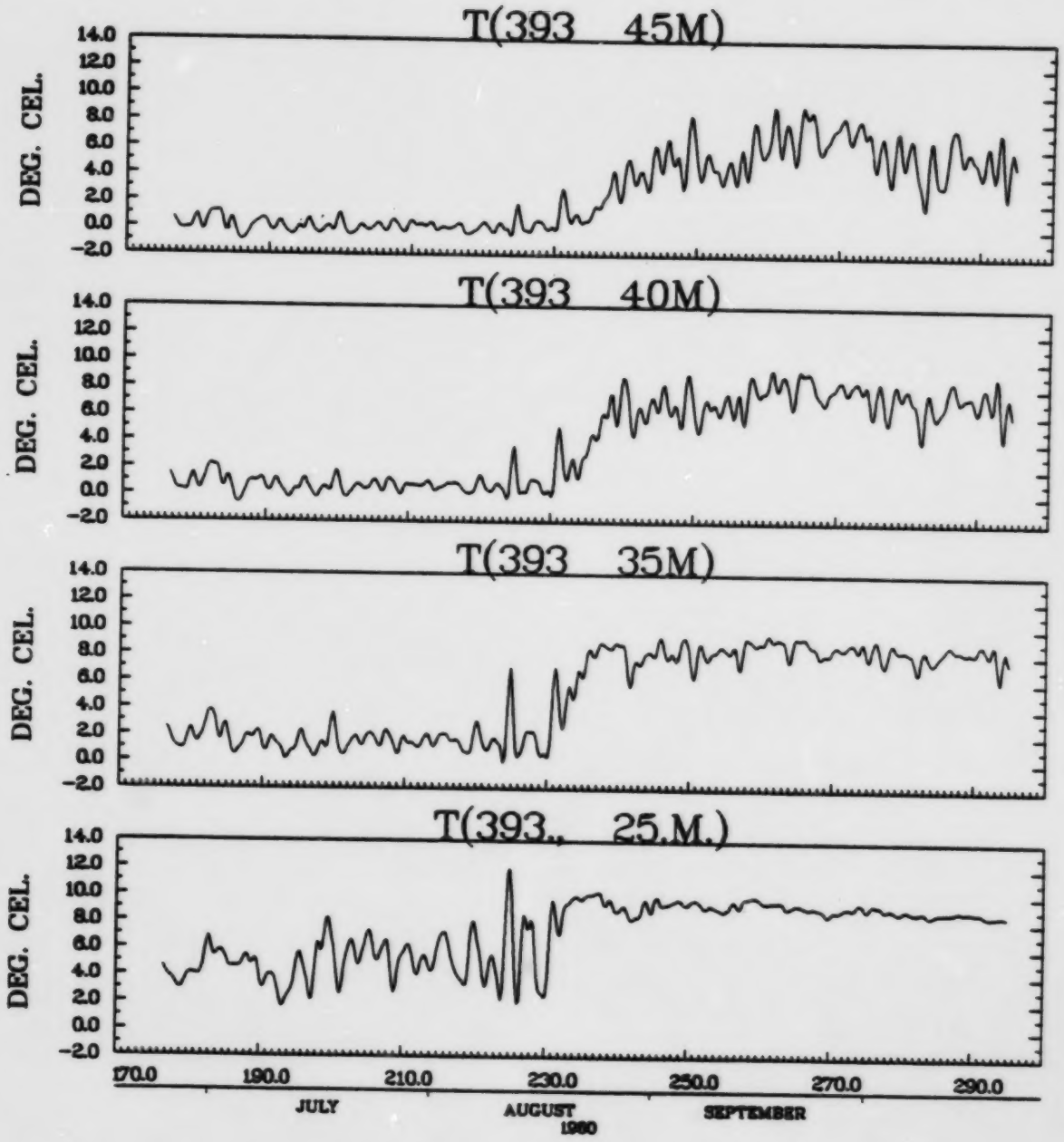
AVALON CHANNEL JUNE – OCTOBER 1980



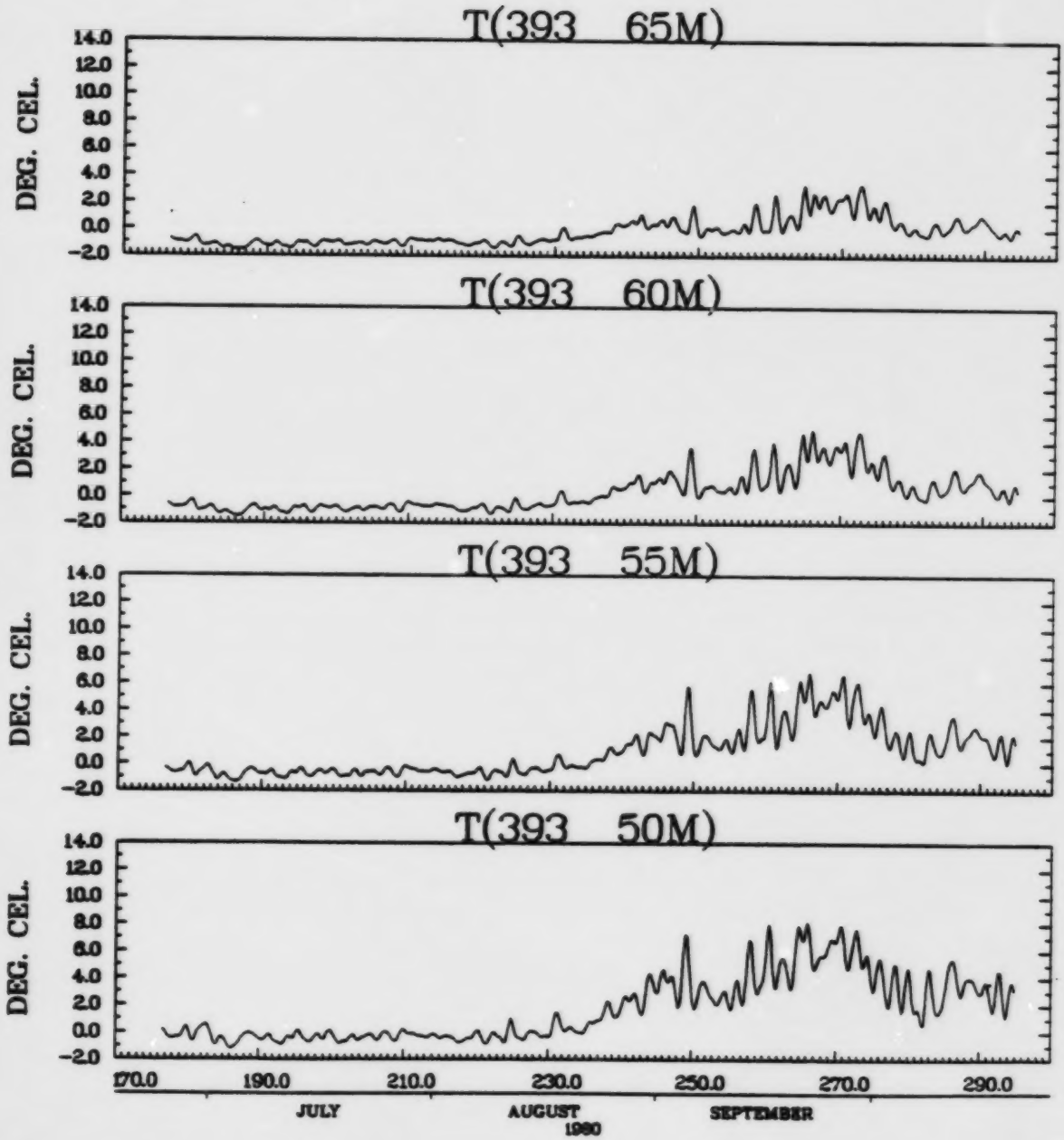
AVALON CHANNEL JUNE – OCTOBER 1980



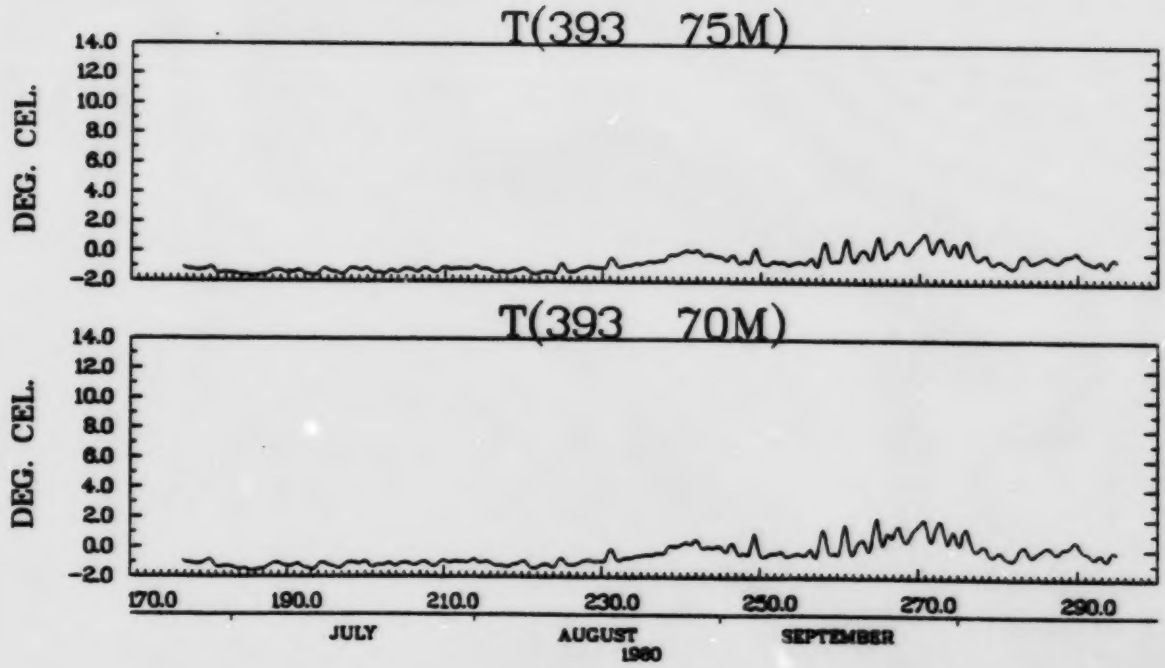
AVALON CHANNEL JUNE - OCTOBER 1980



AVALON CHANNEL JUNE - OCTOBER 1980

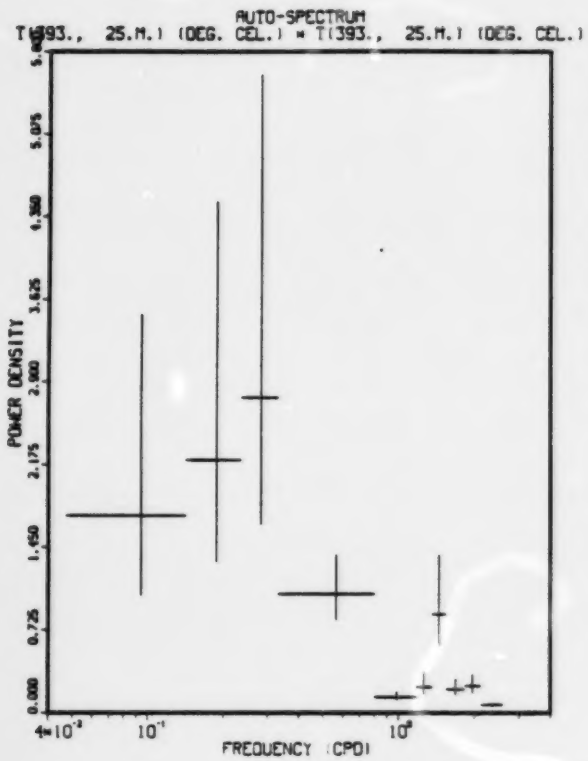


AVALON CHANNEL JUNE - OCTOBER 1980

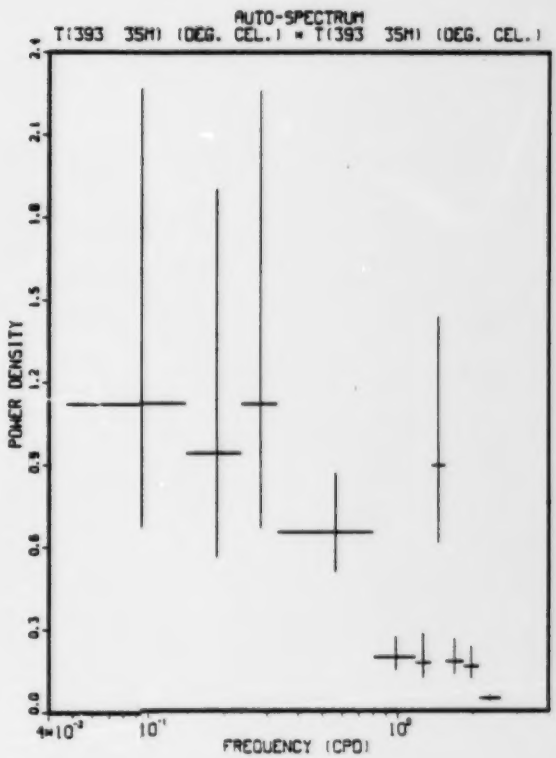


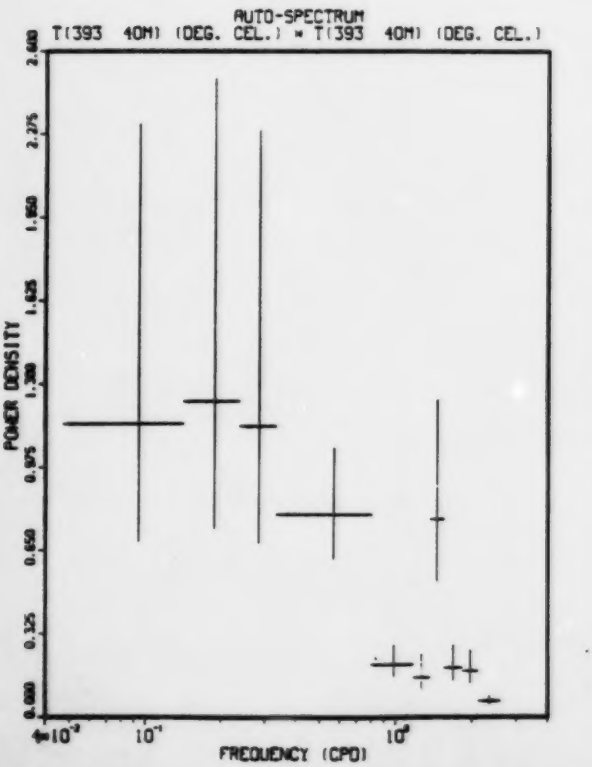
AVALON CHANNEL JUNE – OCTOBER 1980

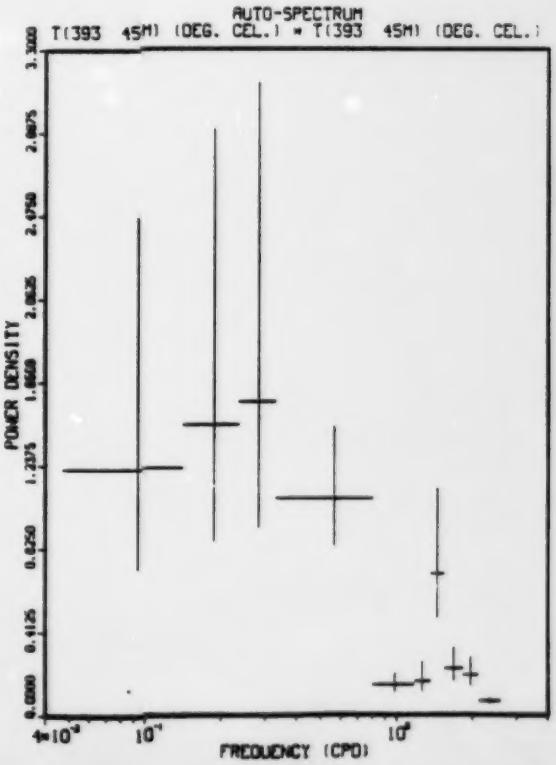
AVALON CHANNEL JUNE - OCTOBER 1980



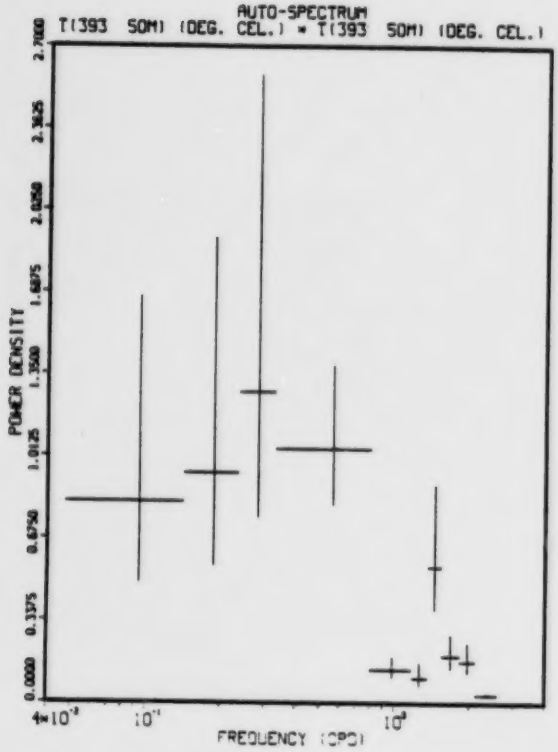
AVALON CHANNEL JUNE - OCTOBER 1980



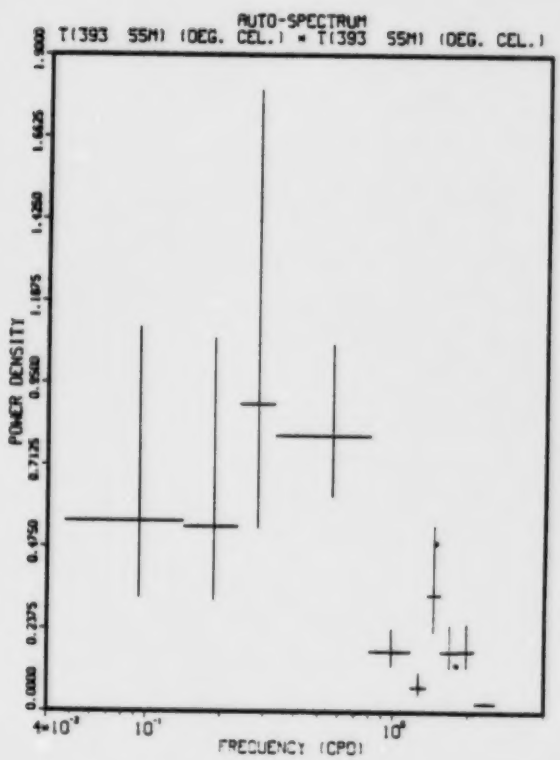


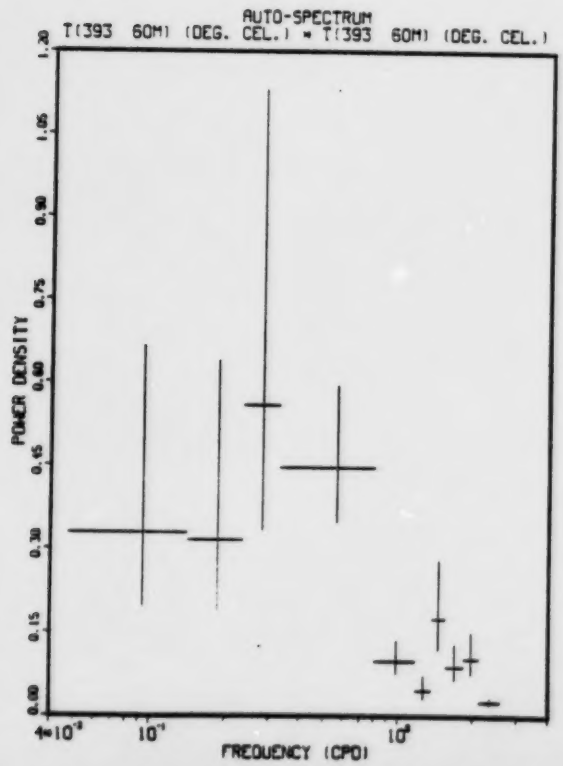


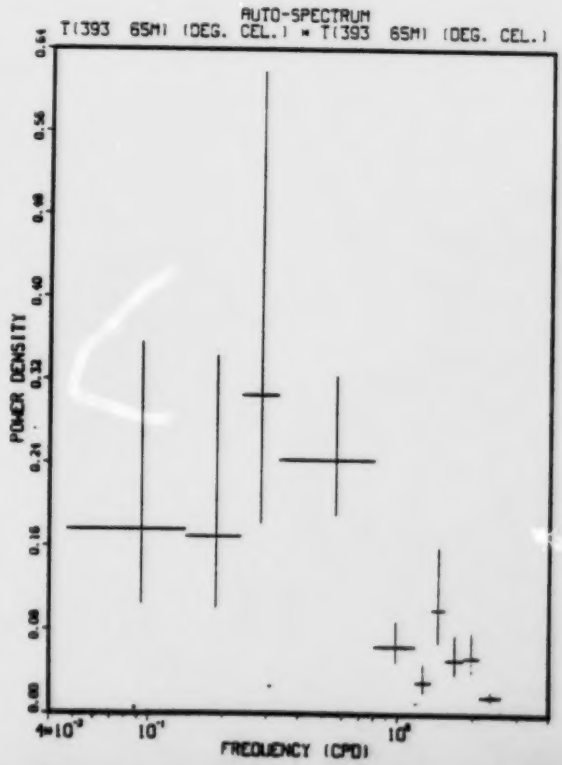
AVALON CHANNEL JUNE - OCTOBER 1980



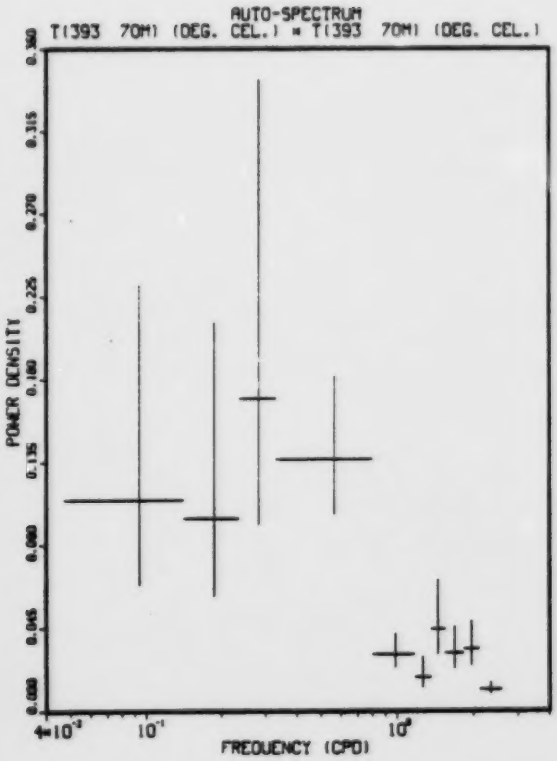
AVALON CHANNEL JUNE - OCTOBER 1980



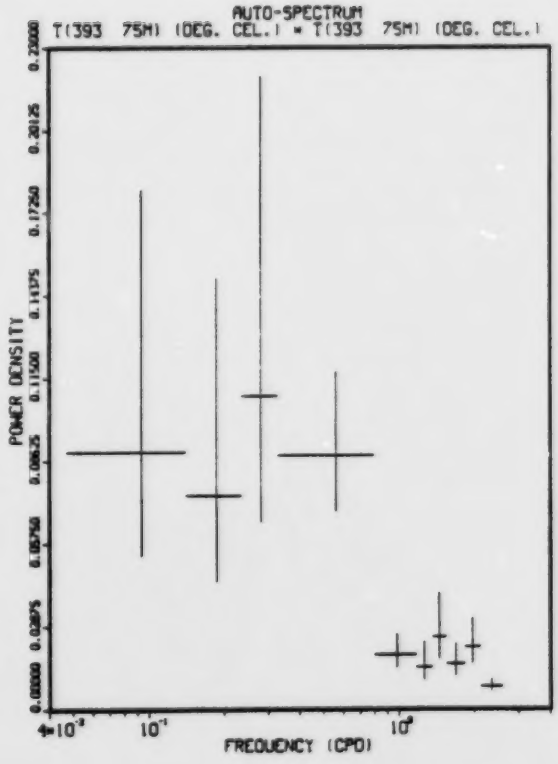




AVALON CHANNEL JUNE - OCTOBER 1980



AVALON CHANNEL JUNE - OCTOBER 1980



MOORING 393

DEPTH (M) 80

INSTRUMENT TYPE/SERIAL NUMBER	AANDERAA RCM4 820
LATITUDE	47 30.06 N
LONGITUDE	52 34.96 W
WATER DEPTH (M)	175
MOORING DATE/CRUISE	21/ 6/1980 80019
DURATION (DAYS)	123.7
SAMPLE INTERVAL (MINUTES)	30

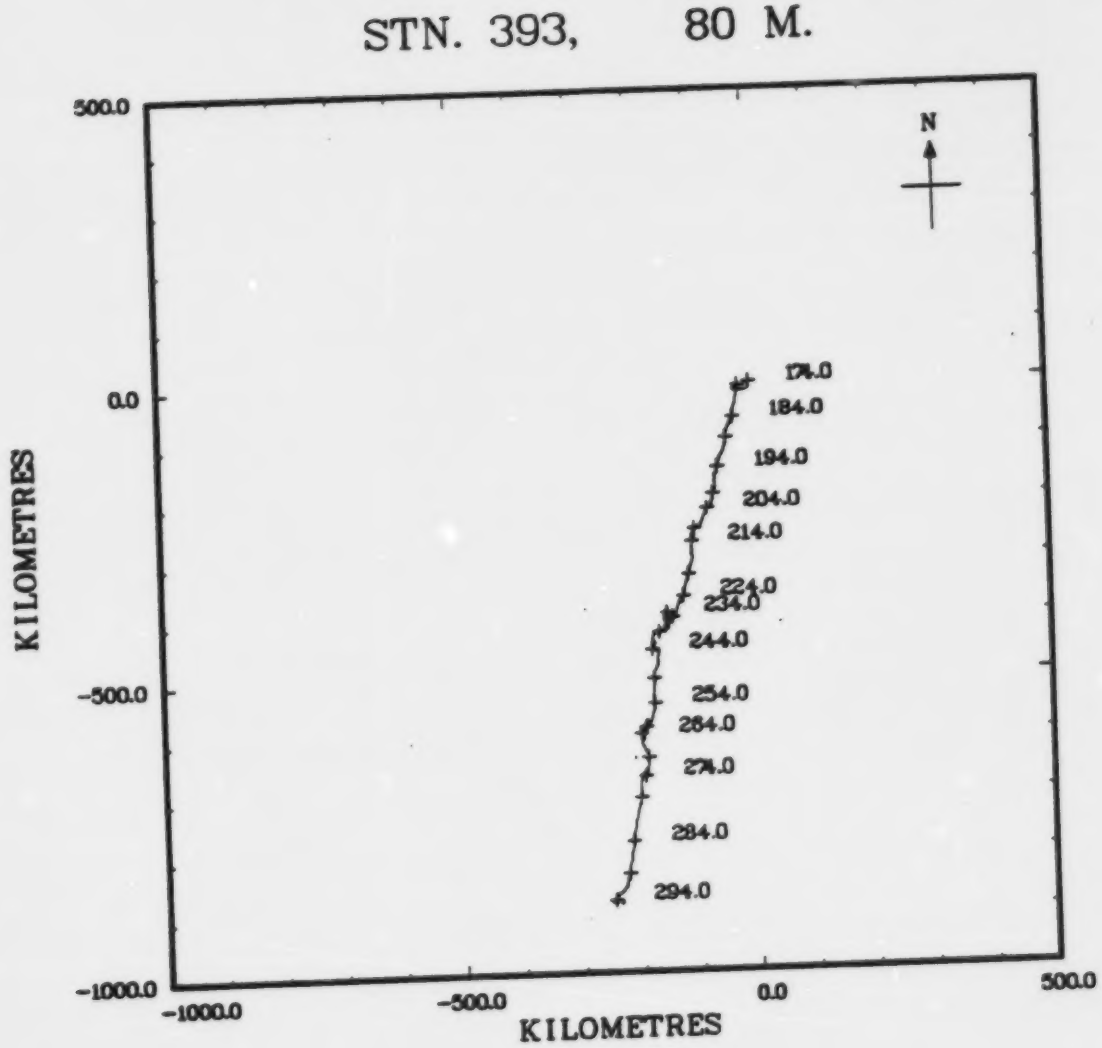
VARIABLE (UNITS)	MEAN	MIN	MAX	STD. DEV.	SAMPLES
E COMP VEL(M/S)	-.022	-.214	.196	.066	5936
N COMP VEL(M/S)	-.083	-.418	.407	.114	5936
TEMPERATURE (^{o}C)					
SALINITY					

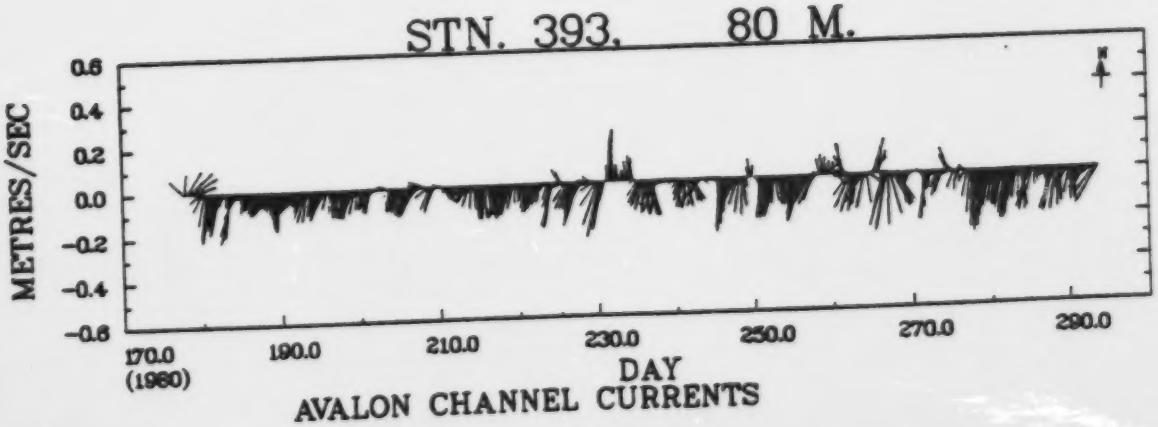
LOW PASS FILTER SAMPLE INTERVAL 6H

	E VELOCITY	N VELOCITY	TEMPERATURE	SALINITY
MEAN	-.022	-.085		
STD. DEV.	.035	.081		

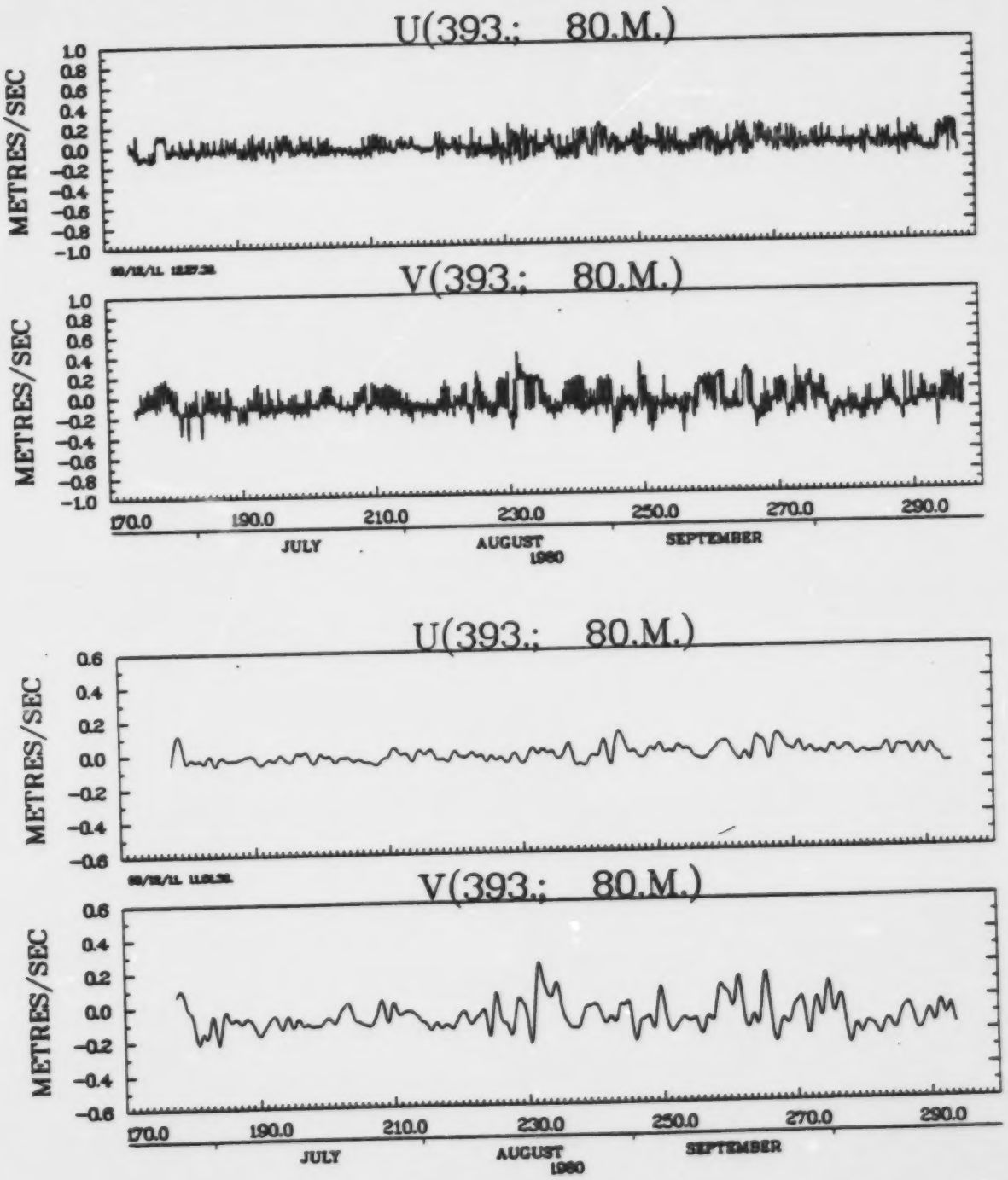
COMMENTS

TEMPERATURE SENSOR FAILED



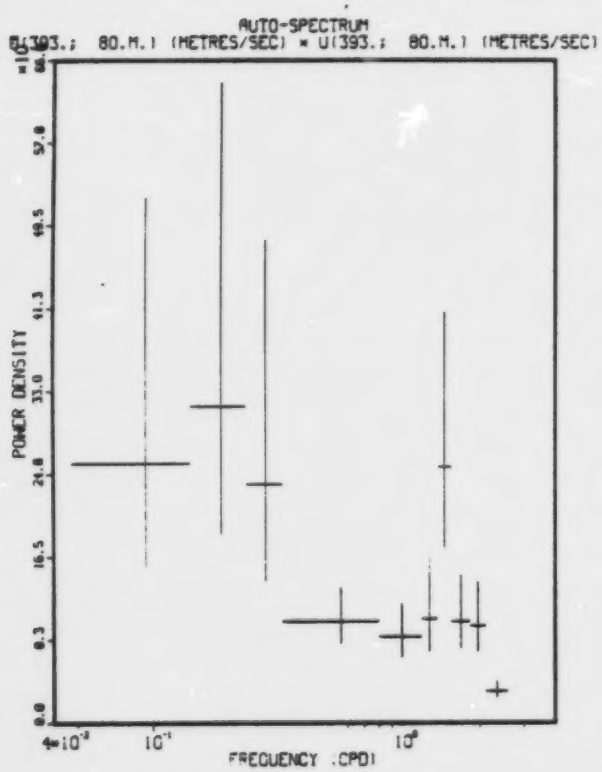


AVALON CHANNEL CURRENTS

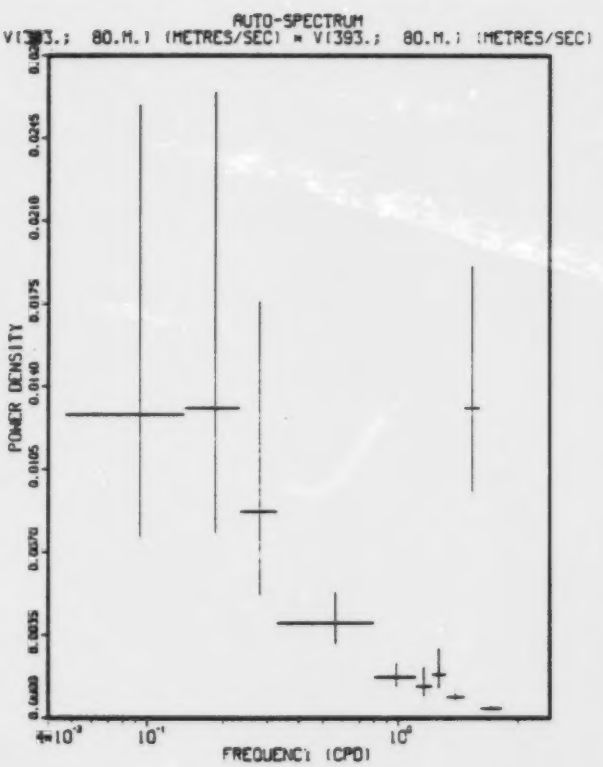


AP1(393.; 80) AVALON CHANNEL JUNE 21–OCT.23/80

AP1(393.; 80) AVALON CHANNEL JUNE 21-OCT.23/80



AP1(393.; 80) AVALON CHANNEL JUNE 21-OCT.23/80



MOORING 393

DEPTH (M) 130

INSTRUMENT TYPE/SERIAL NUMBER	AANDERAA RCM4 1607
LATITUDE	47 30.06 N
LONGITUDE	52 34.96 W
WATER DEPTH (M)	175
MOORING DATE/CRUISE	21/ 6/1980 80019
DURATION (DAYS)	123.7
SAMPLE INTERVAL (MINUTES)	30

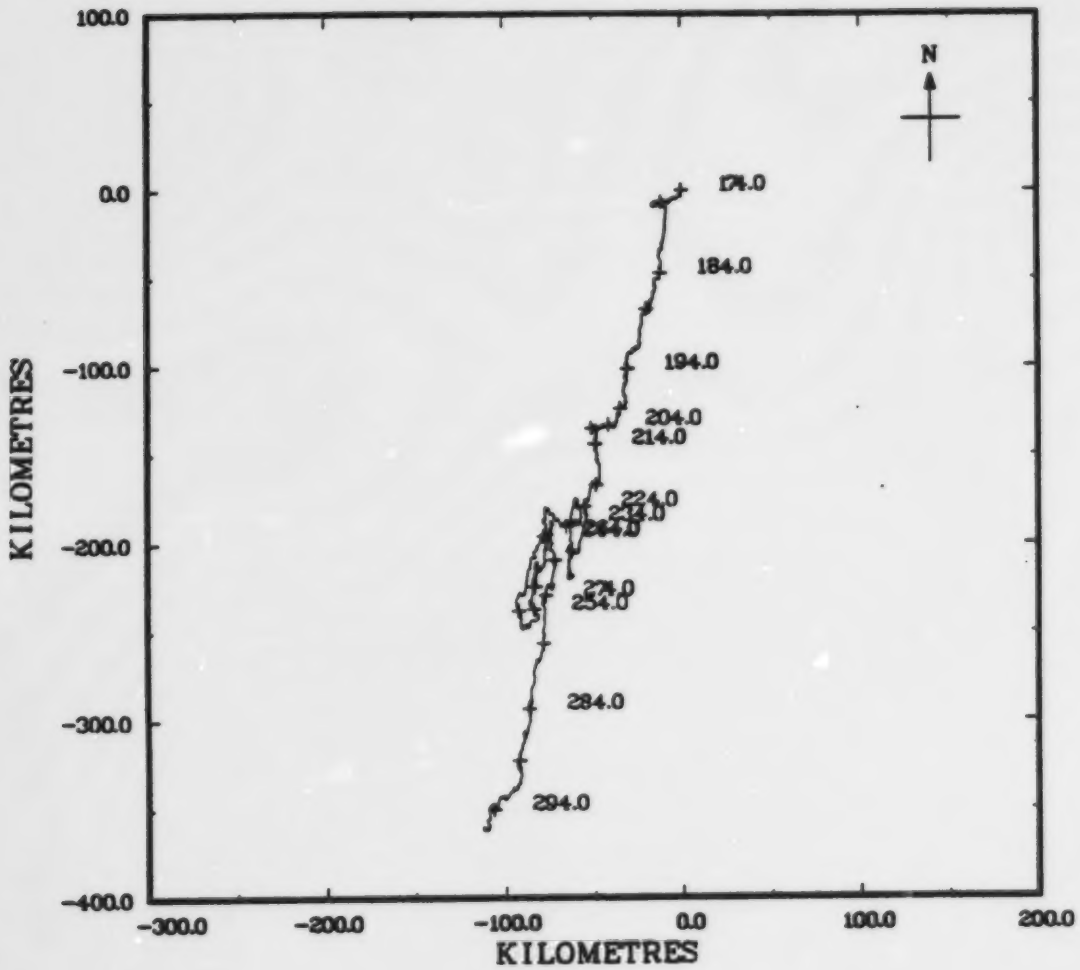
VARIABLE (UNITS)	MEAN	MIN	MAX	STD. DEV.	SAMPLES
E COMP VEL(M/S)	-.011	-.182	.142	.048	5937
N COMP VEL(M/S)	-.034	-.421	.400	.105	5937
TEMPERATURE (^{o}C)	-1.53	-1.73	-1.02	.11	5937
SALINITY	33.05	32.81	33.32	.06	5937

LOW PASS FILTER SAMPLE INTERVAL 6H

	E VELOCITY	N VELOCITY	TEMPERATURE	SALINITY
MEAN	-.009	-.034	-1.53	33.05
STD. DEV.	.026	.074	.10	.05

COMMENTS

STN. 393, 130 M.



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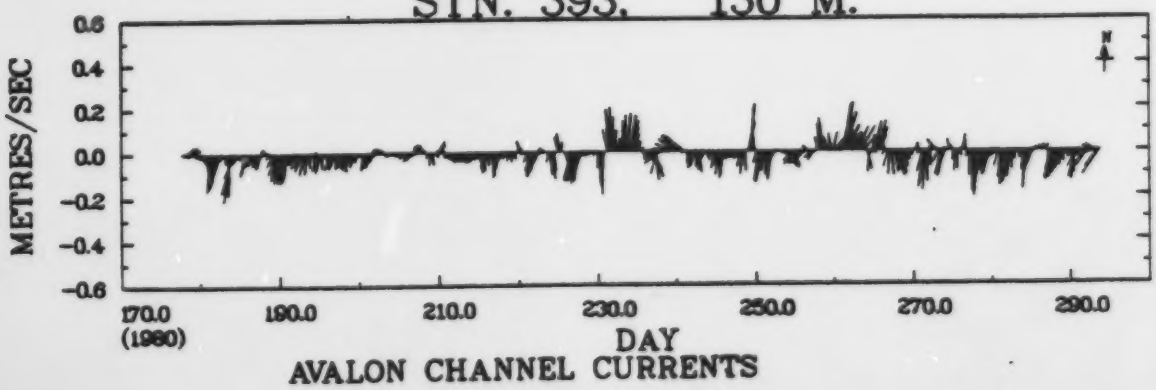
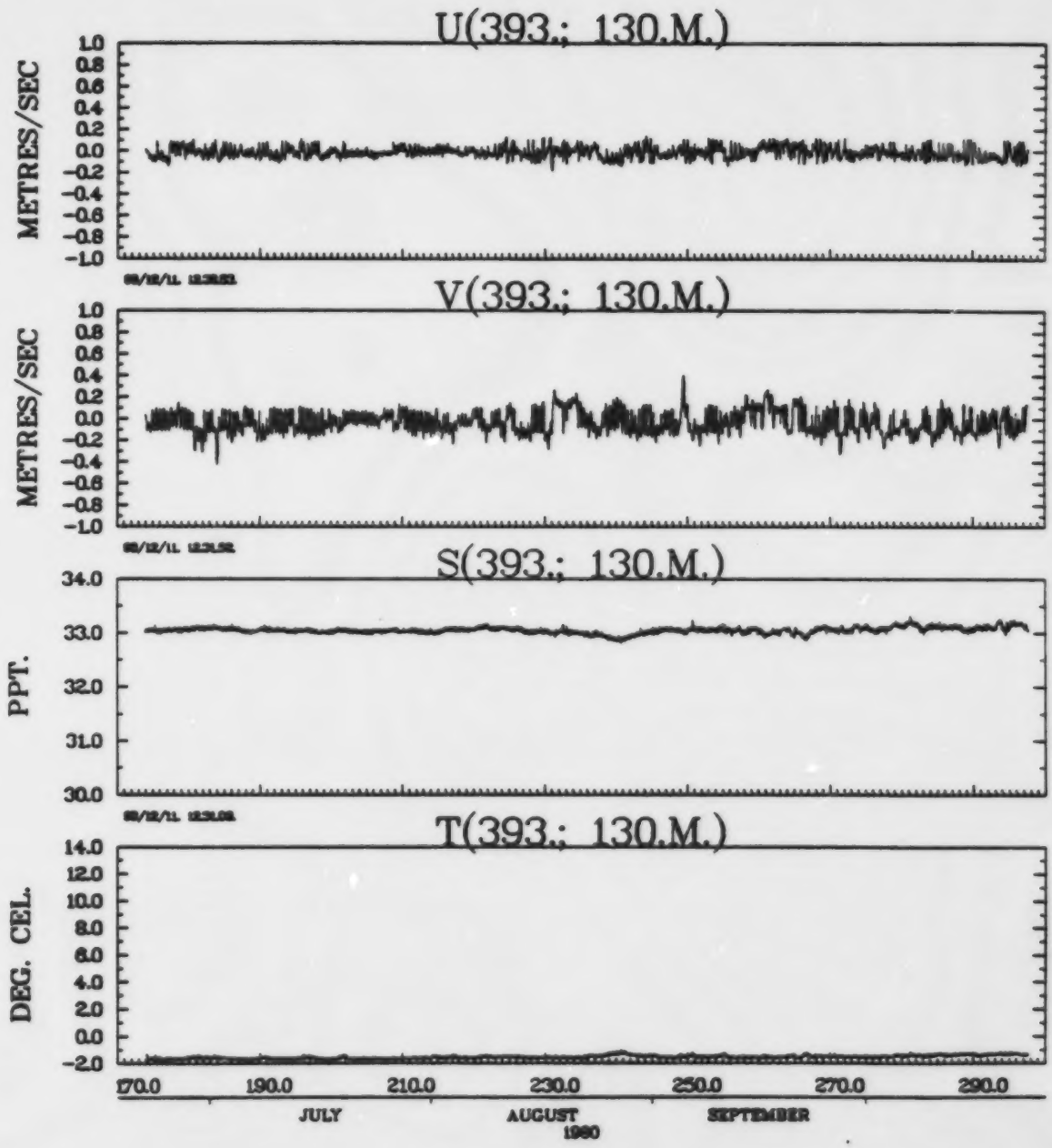
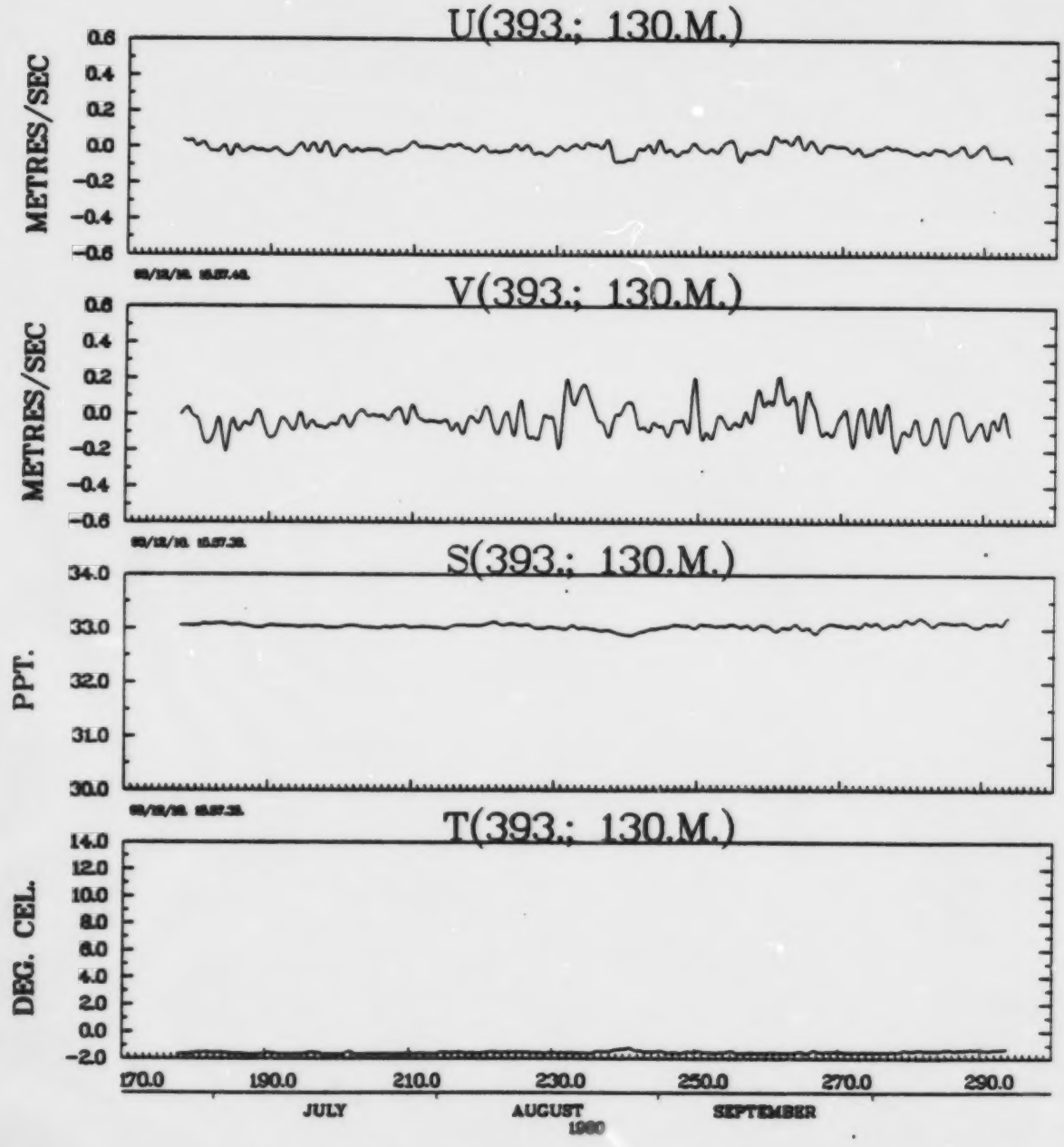


AVALON CHANNEL CURRENTS

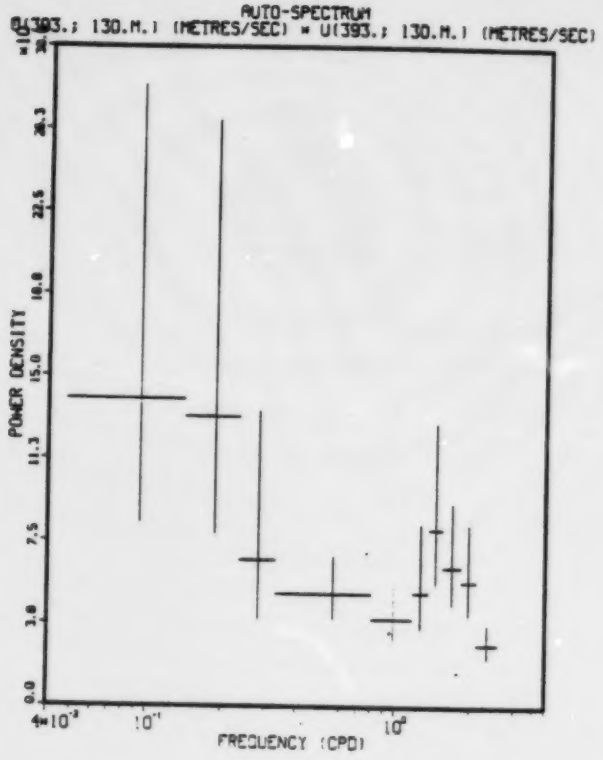


AP1(393.; 130) AVALON CHANNEL JUNE 21-OCT.23/80

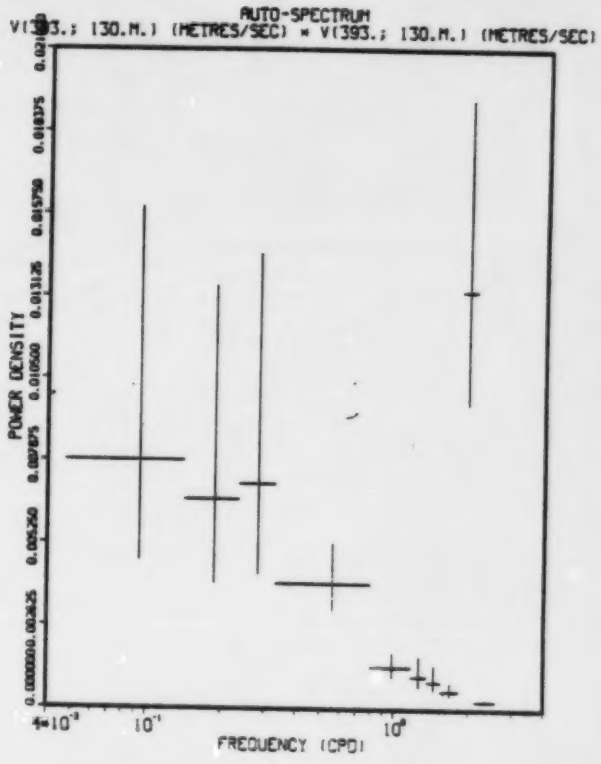


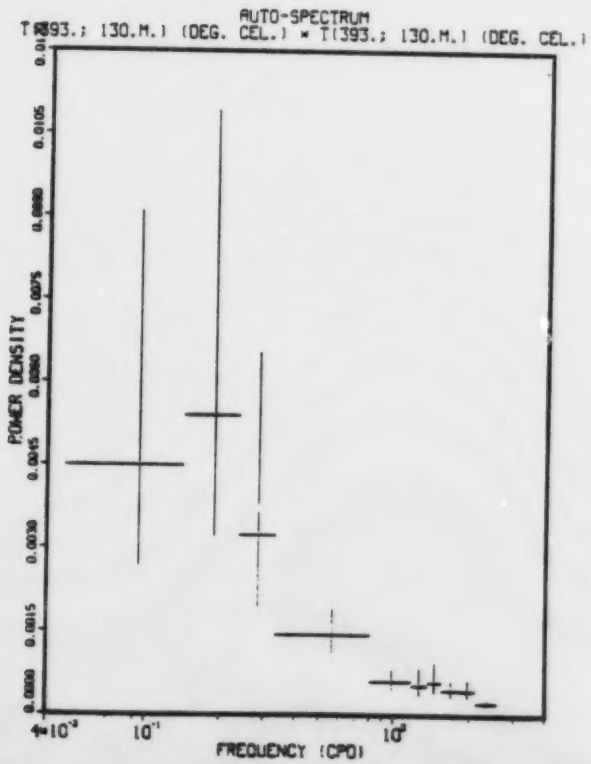
AP1(393.; 130) AVALON CHANNEL JUNE 21-OCT.23/80

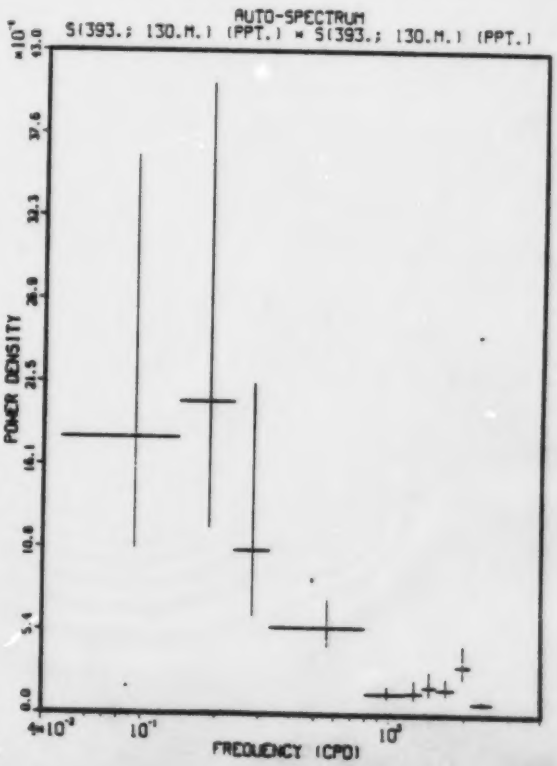
AP1(393.; 130) AVALON CHANNEL JUNE 21-OCT.23/80



AP1(393.; 130) AVALON CHANNEL JUNE 21-OCT.23/80







MOORING 394

DEPTH (M) 29

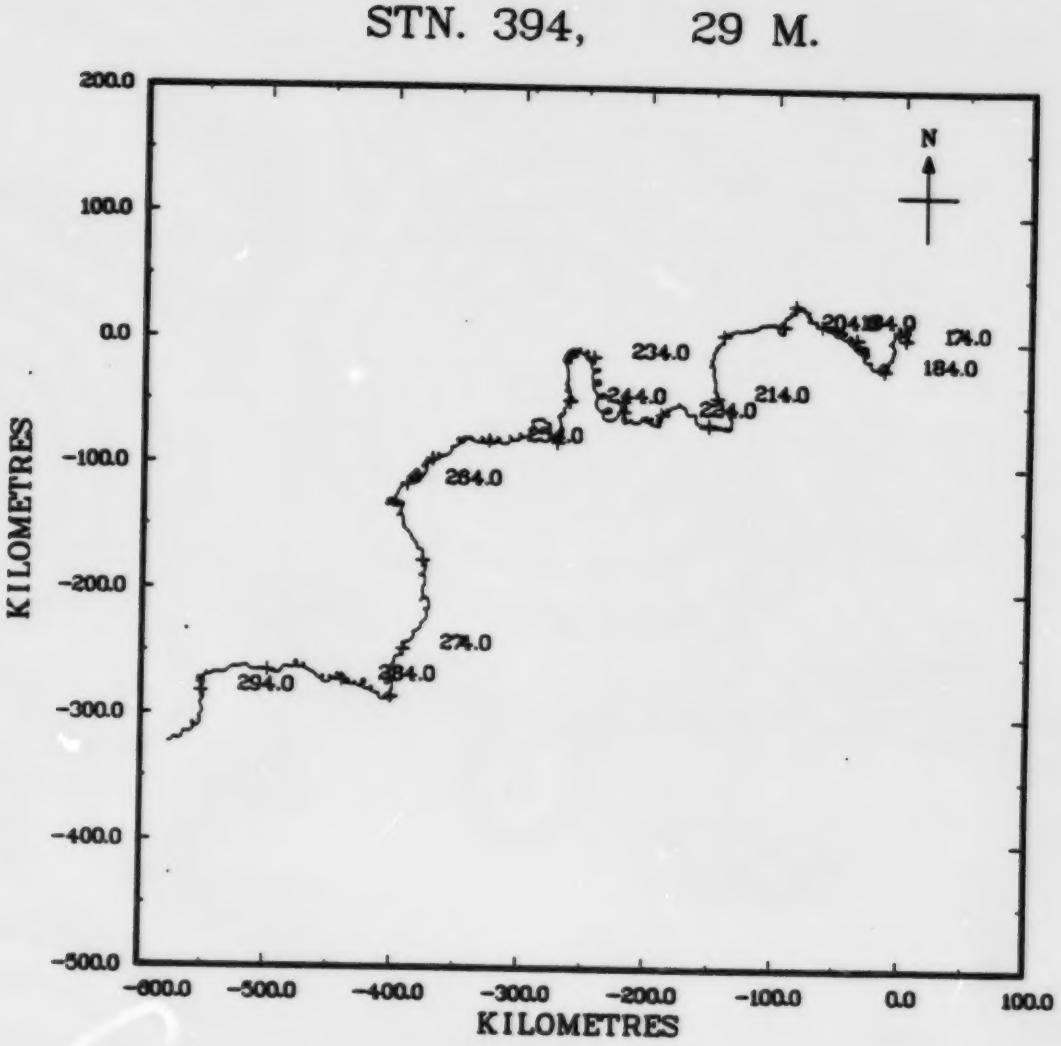
INSTRUMENT TYPE/SERIAL NUMBER	AANDERAA RCM4 1277
LATITUDE	47 25.92 N
LONGITUDE	52 18.91 W
WATER DEPTH (M)	160
MOORING DATE/CRUISE	21/ 6/1980 80019
DURATION (DAYS)	123.7
SAMPLE INTERVAL (MINUTES)	30

VARIABLE (UNITS)	MEAN	MIN	MAX	STD. DEV.	SAMPLES
E COMP VEL(M/S)	-.054	-.552	.527	.144	5937
N COMP VEL(M/S)	-.030	-.612	.806	.171	5937
TEMPERATURE (^{o}C)	7.12	1.00	11.52	2.34	5937
SALINITY	31.77	30.86	32.99	.48	5937

LOW PASS FILTER SAMPLE INTERVAL 6H

	E VELOCITY	N VELOCITY	TEMPERATURE	SALINITY
MEAN	-.054	-.029	7.20	31.78
STD. DEV.	.067	.091	2.08	.45

COMMENTS


STN. 394, 29 M.
N
KILOMETRES
KILOMETRES
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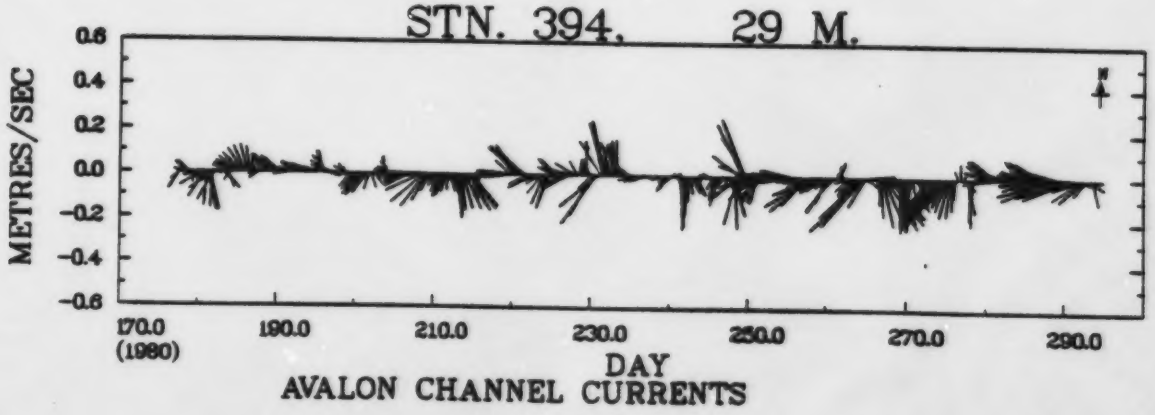
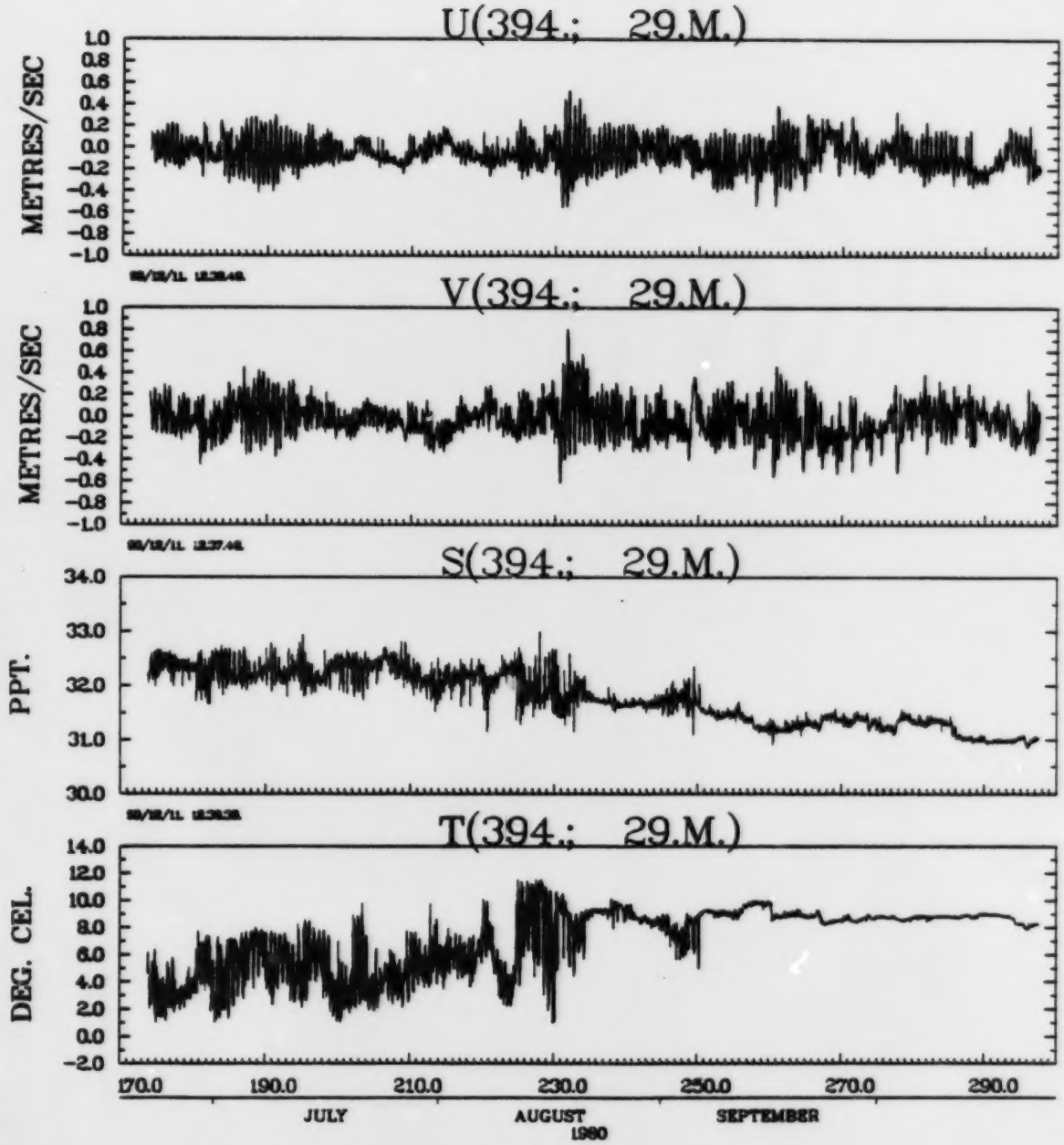
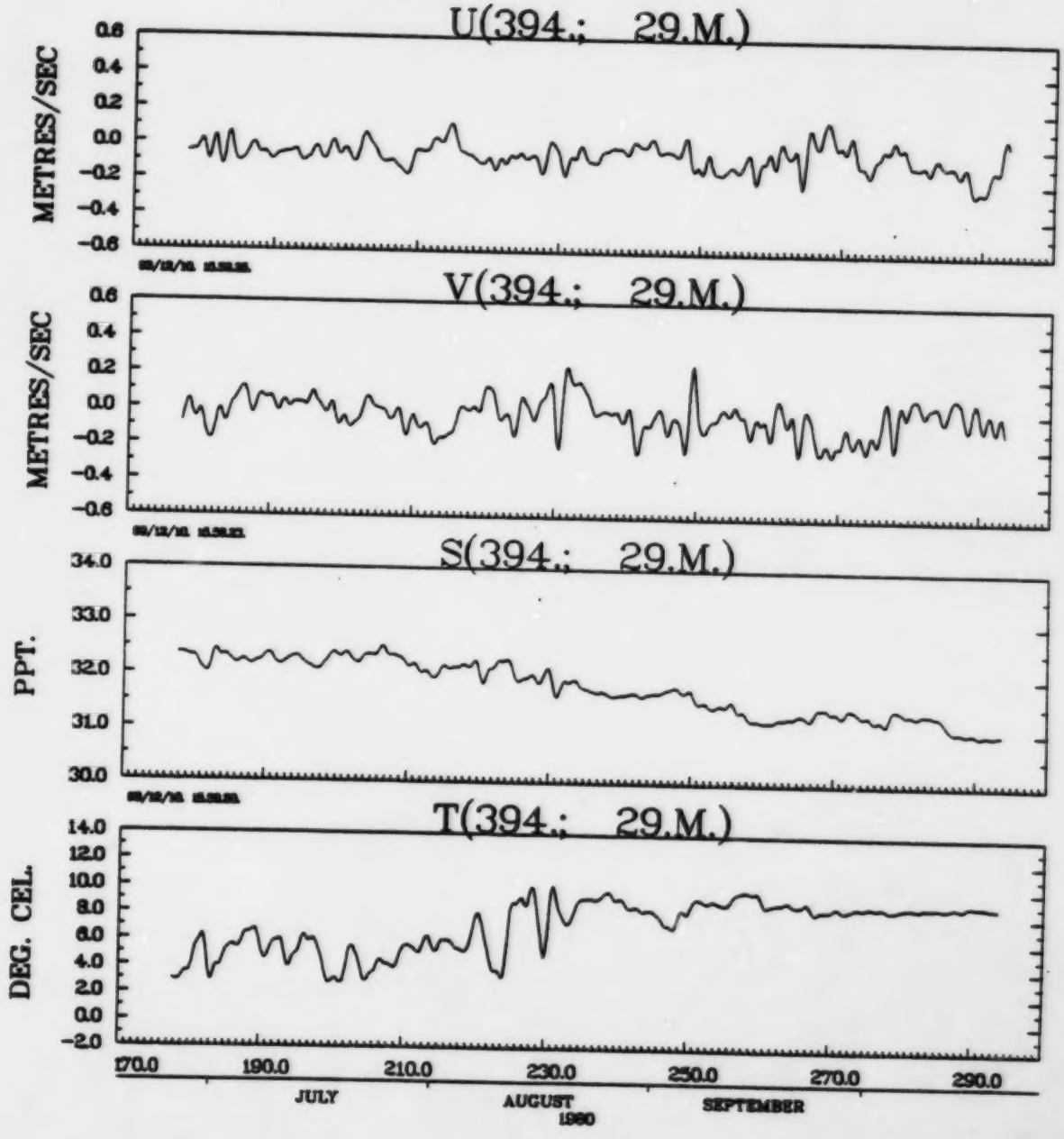
100.0
0.0
-100.0
-200.0
-300.0
-400.0
-500.0
-600.0
-500.0
-400.0
-300.0
-200.0
-100.0
0.0
100.0
174.0
184.0
204.0
214.0
224.0
234.0
244.0
254.0
264.0
274.0
284.0
294.0


STN. 394. 29 M.
METRES/SEC
DAY
AVALON CHANNEL CURRENTS
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
170.0
(1980)
190.0
210.0
230.0
250.0
270.0
290.0

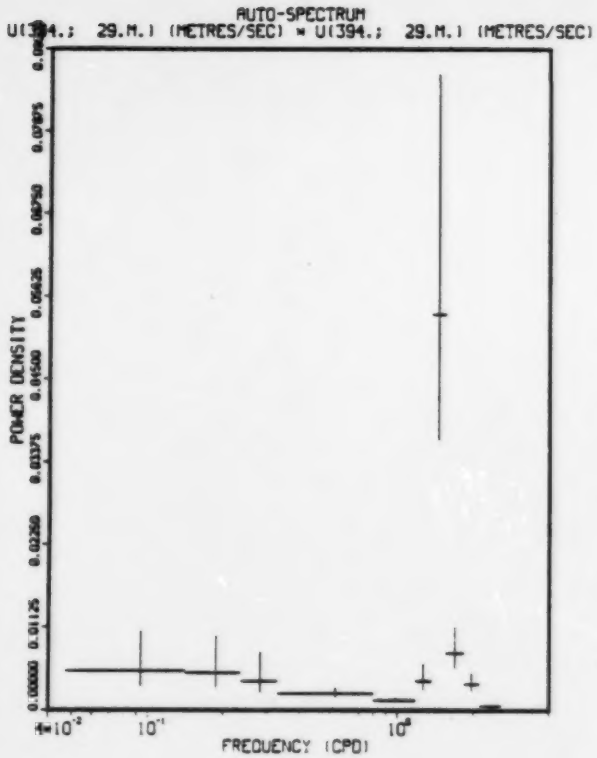


AP2(394.; 29) AVALON CHANNEL JUNE 21-OCT.23/80

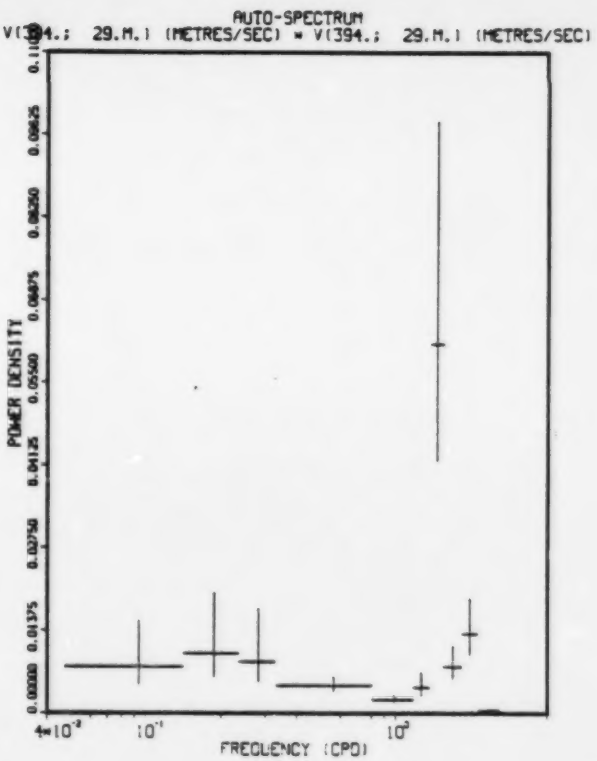


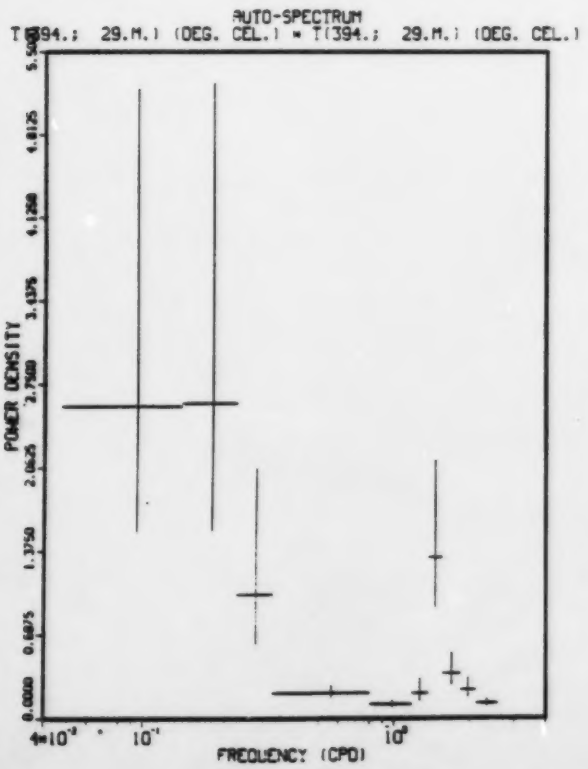
AP2(394.; 29) AVALON CHANNEL JUNE 21-OCT.23/80

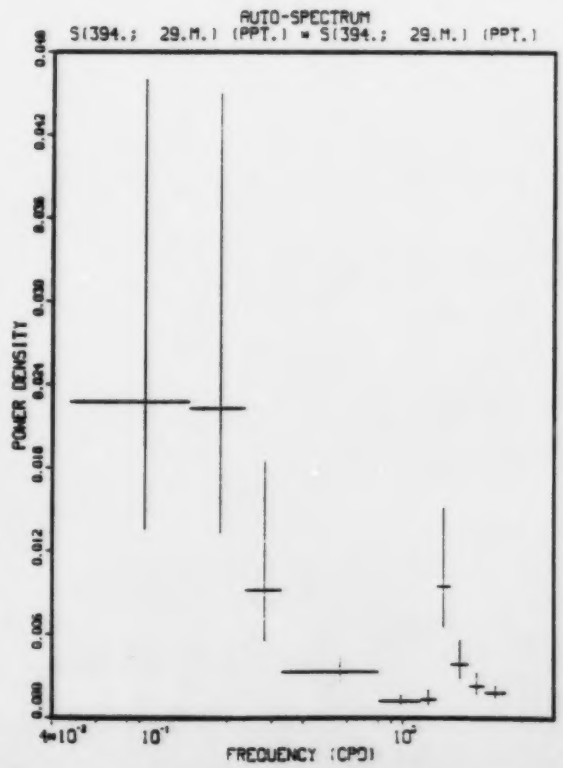
AP2(394.; 29) AVALON CHANNEL JUNE 21-OCT.23/80



AP2(394.; 29) AVALON CHANNEL JUNE 21-OCT.23/80







MOORING 394

DEPTH (M) 54

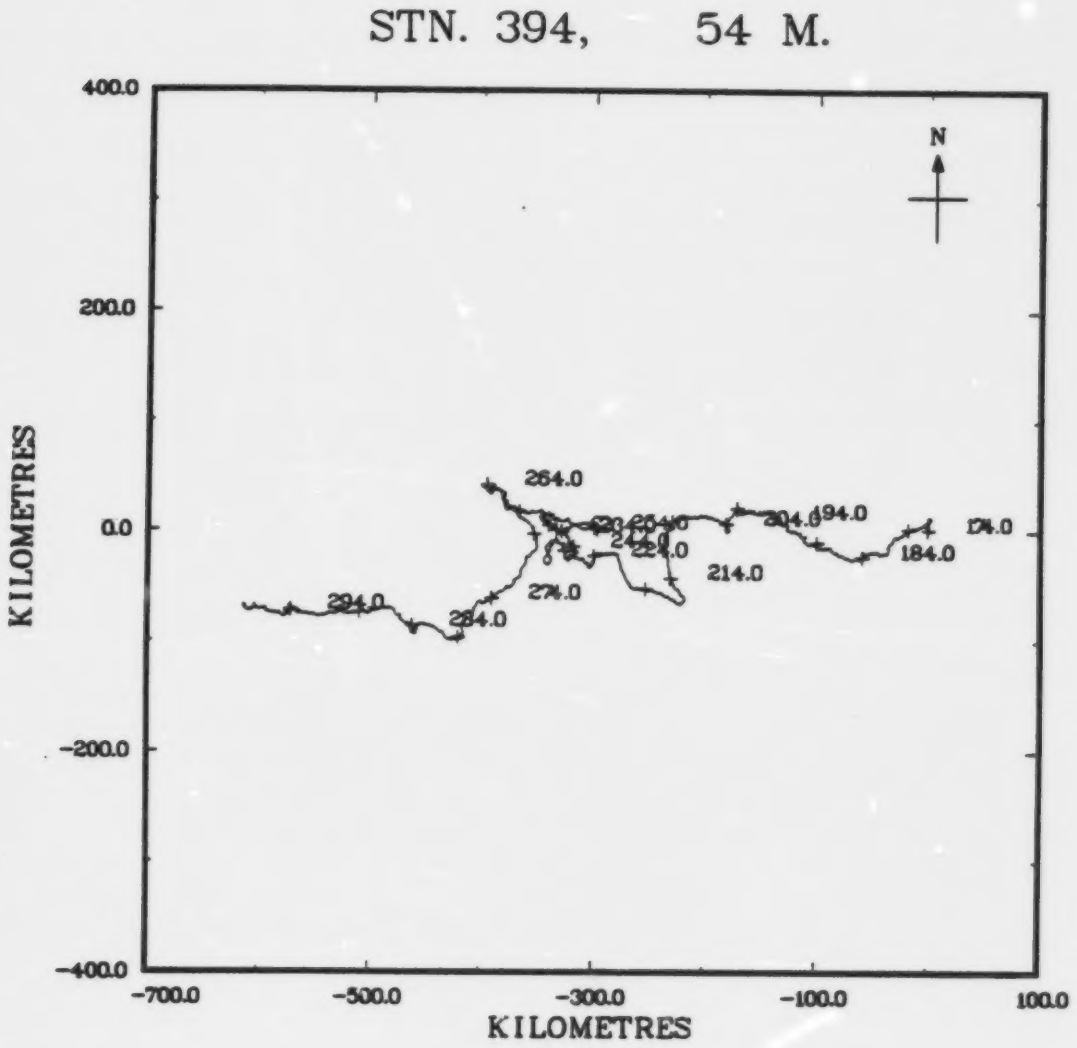
INSTRUMENT TYPE/SERIAL NUMBER	AANDERAA RCM4 1282
LATITUDE	47 25.92 N
LONGITUDE	52 18.91 W
WATER DEPTH (M)	160
MOORING DATE/CRUISE	21/ 6/1980 80019
DURATION (DAYS)	123.7
SAMPLE INTERVAL (MINUTES)	30

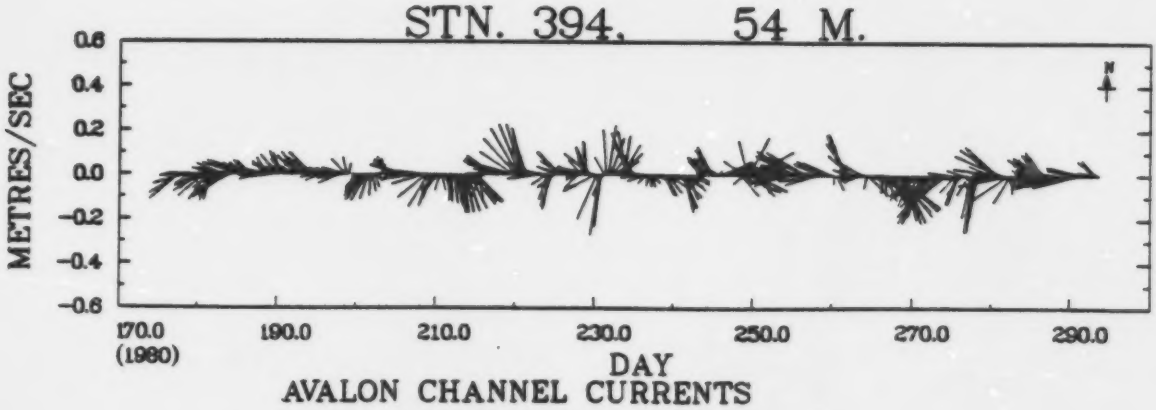
VARIABLE (UNITS)	MEAN	MIN	MAX	STD. DEV.	SAMPLES
E COMP VEL(M/S)	-.057	-.364	.363	.120	5937
N COMP VEL(M/S)	-.007	-.334	.433	.129	5937
TEMPERATURE (^{o}C)	.42	-1.59	8.89	2.11	5937
SALINITY	32.58	30.99	33.18	.36	5937

LOW PASS FILTER SAMPLE INTERVAL 6H

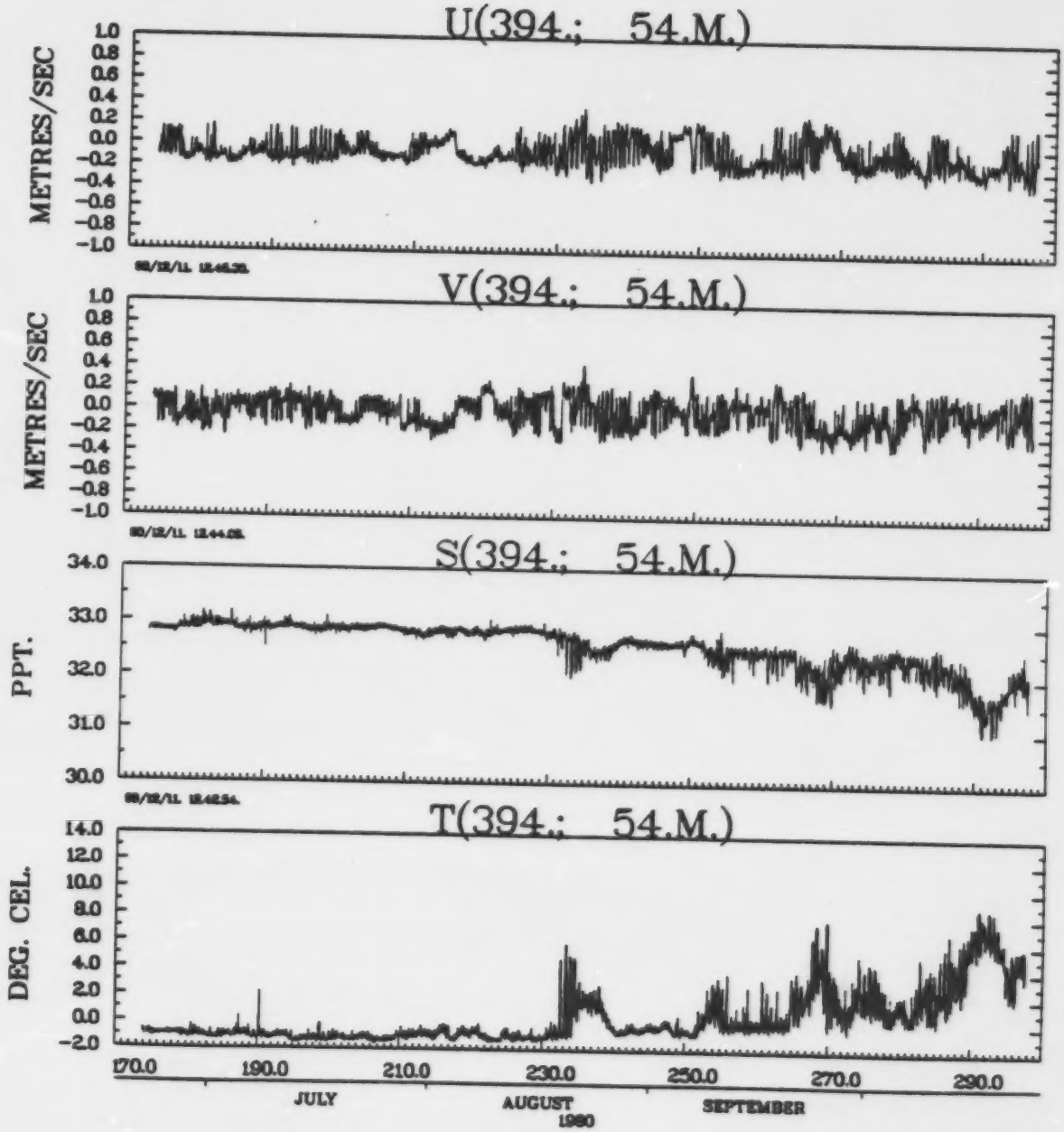
	E VELOCITY	N VELOCITY	TEMPERATURE	SALINITY
MEAN	-.057	-.008	.33	32.74
STD. DEV.	.086	.089	1.90	.34

COMMENTS

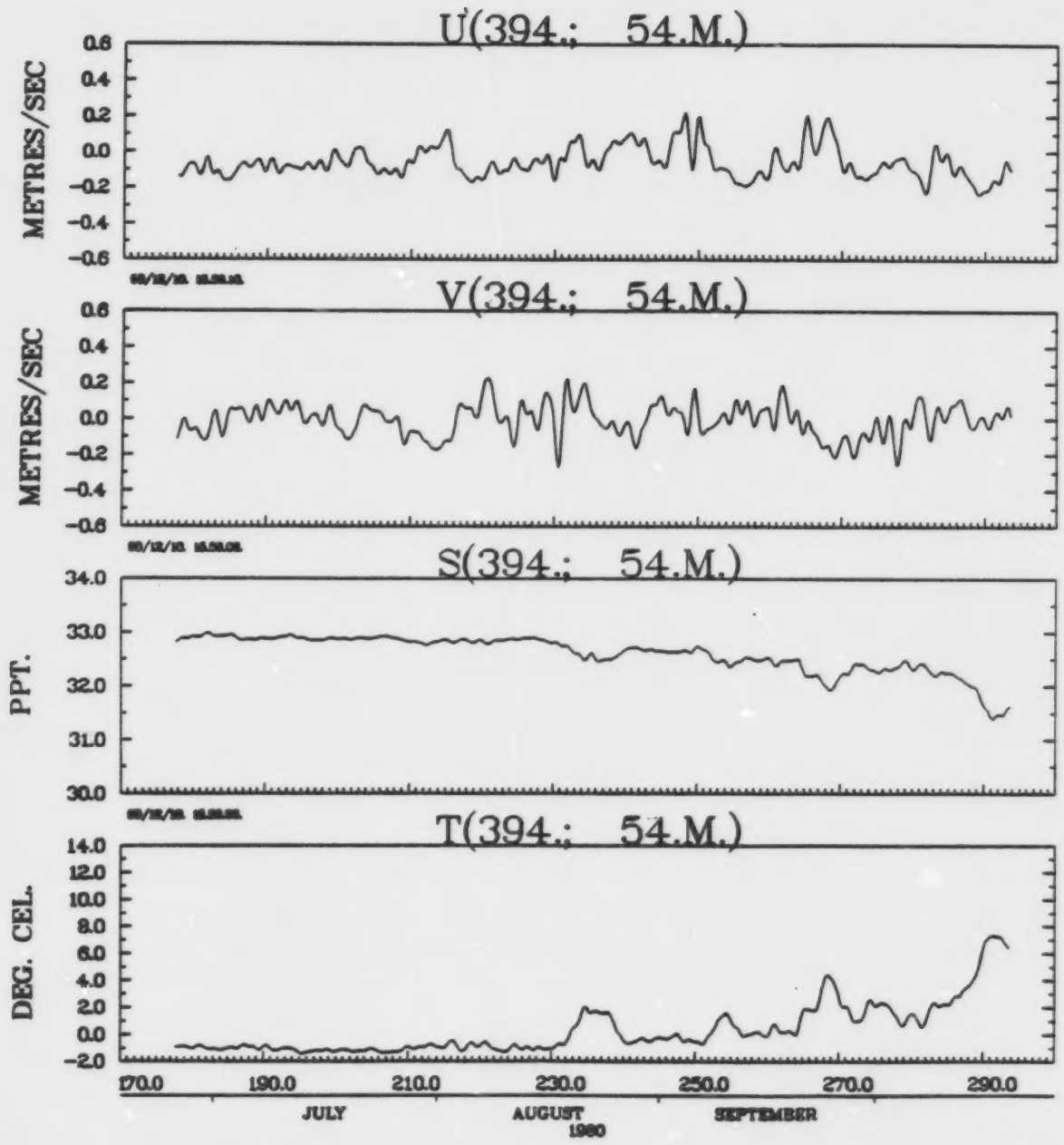




AVALON CHANNEL CURRENTS

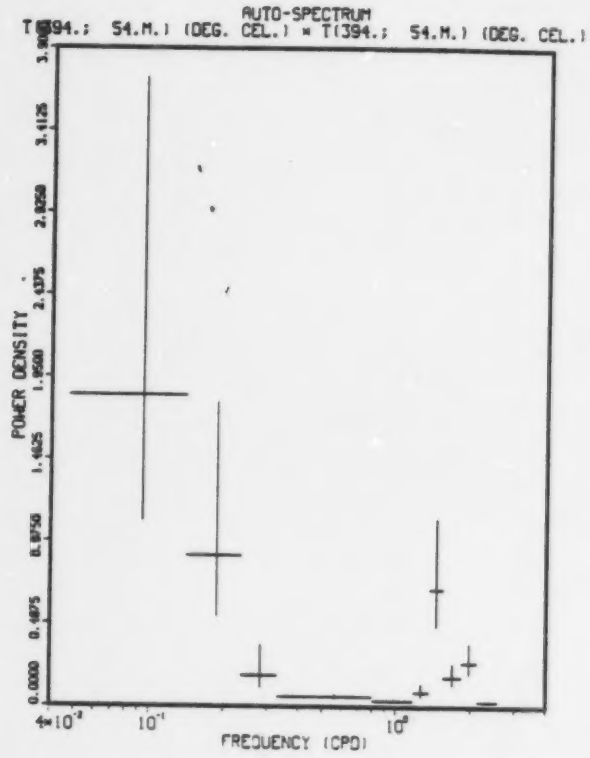


AP2(394.; 54) AVALON CHANNEL JUNE 21-OCT.23/80

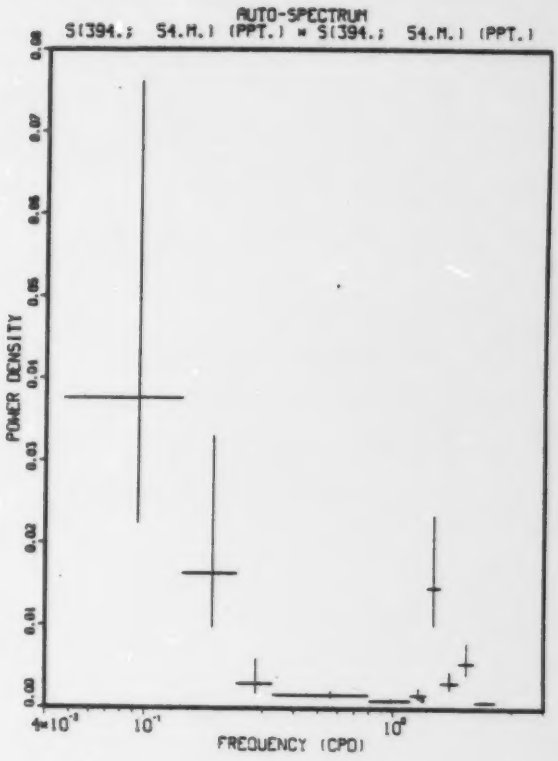


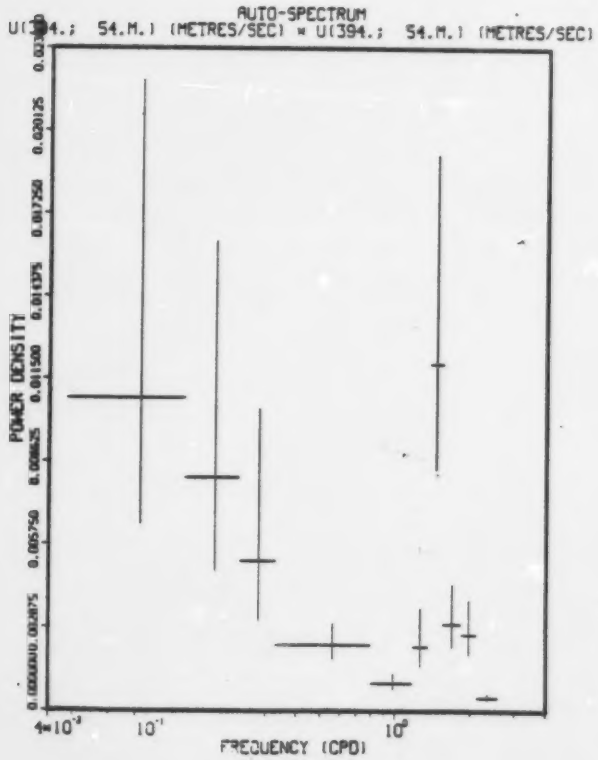
AP2(394.; 54) AVALON CHANNEL JUNE 21-OCT.23/80

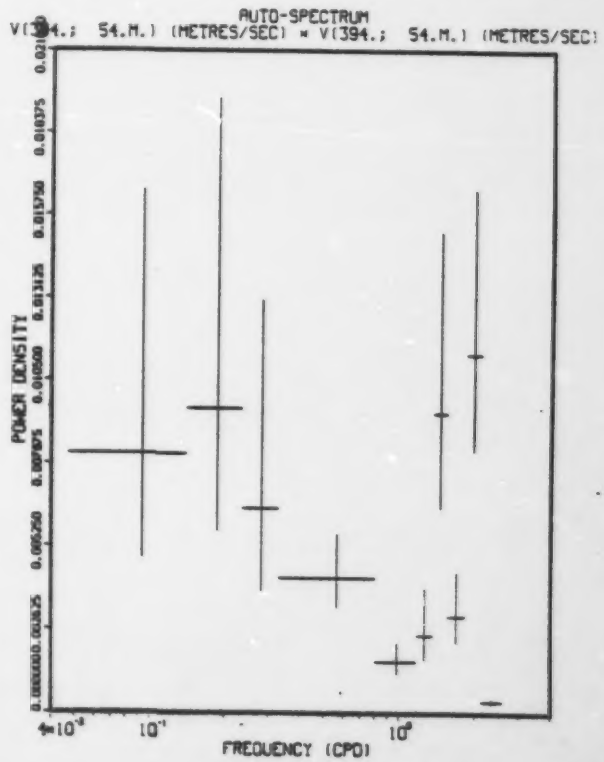
AP2(394.; 54) AVALON CHANNEL JUNE 21-OCT.23/80



AP2(394.; 54) AVALON CHANNEL JUNE 21-OCT.23/80







MOORING 394

DEPTH (M) 104

INSTRUMENT TYPE/SERIAL NUMBER	AANDERAA RCM4 1283
LATITUDE	47 25.92 N
LONGITUDE	52 18.91 W
WATER DEPTH (M)	160
MOORING DATE/CRUISE	21/ 6/1980 80019
DURATION (DAYS)	123.7
SAMPLE INTERVAL (MINUTES)	30

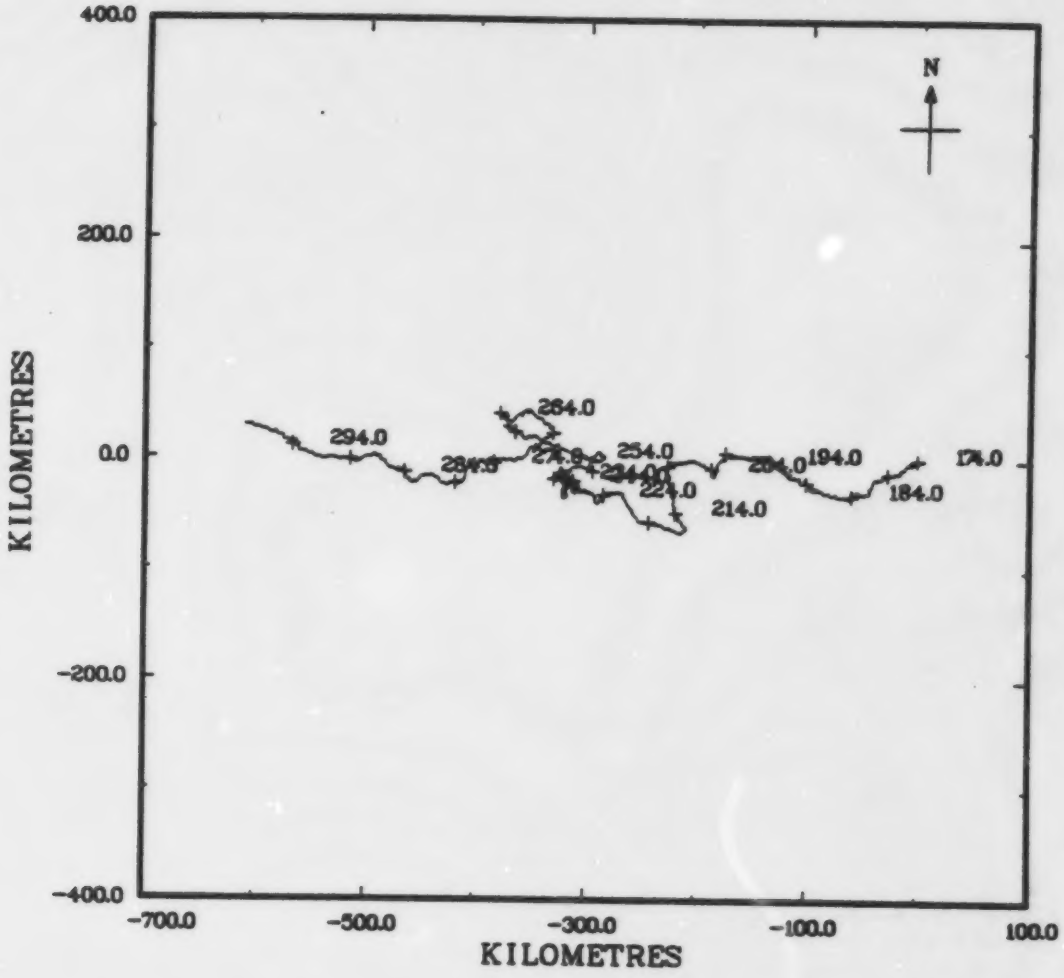
VARIABLE (UNITS)	MEAN	MIN	MAX	STD. DEV.	SAMPLES
E COMP VEL(M/S)	-.057	-.284	.271	.098	5936
N COMP VEL(M/S)	-.003	-.268	.336	.109	5936
TEMPERATURE (^{o}C)	-1.52	-1.70	-.70	.09	5936
SALINITY	32.58	32.39	32.83	.06	5936

LOW PASS FILTER SAMPLE INTERVAL 6H

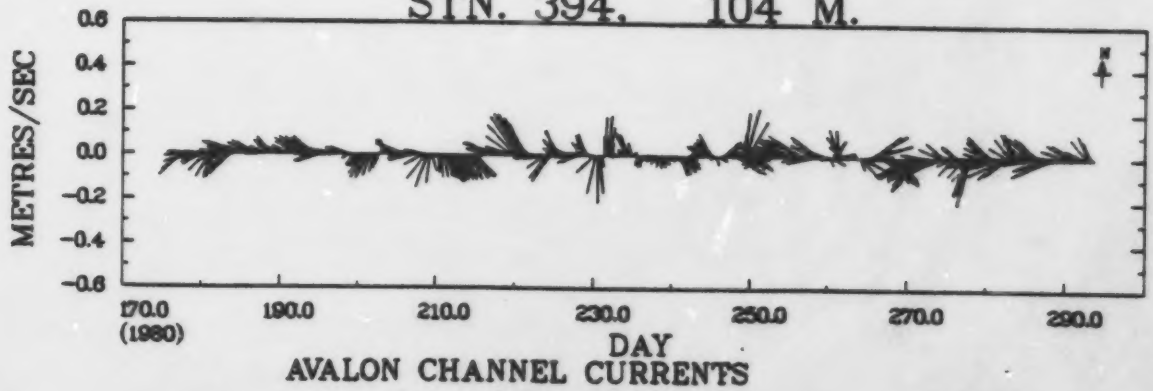
	E VELOCITY	N VELOCITY	TEMPERATURE	SALINITY
MEAN	-.055	-.002	-1.53	32.58
STD. DEV.	.072	.070	.08	.06

COMMENTS

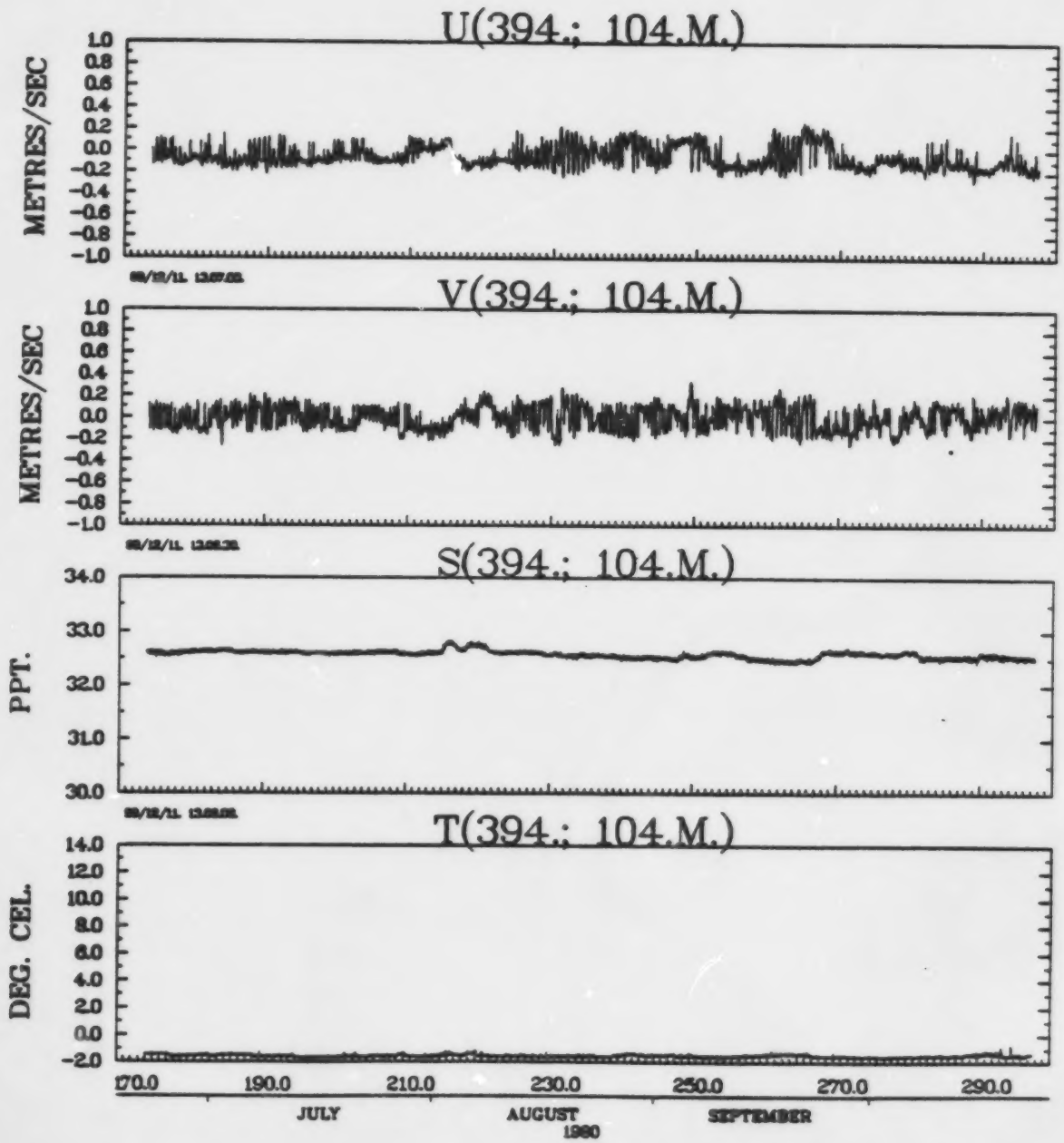
STN. 394, 104 M.



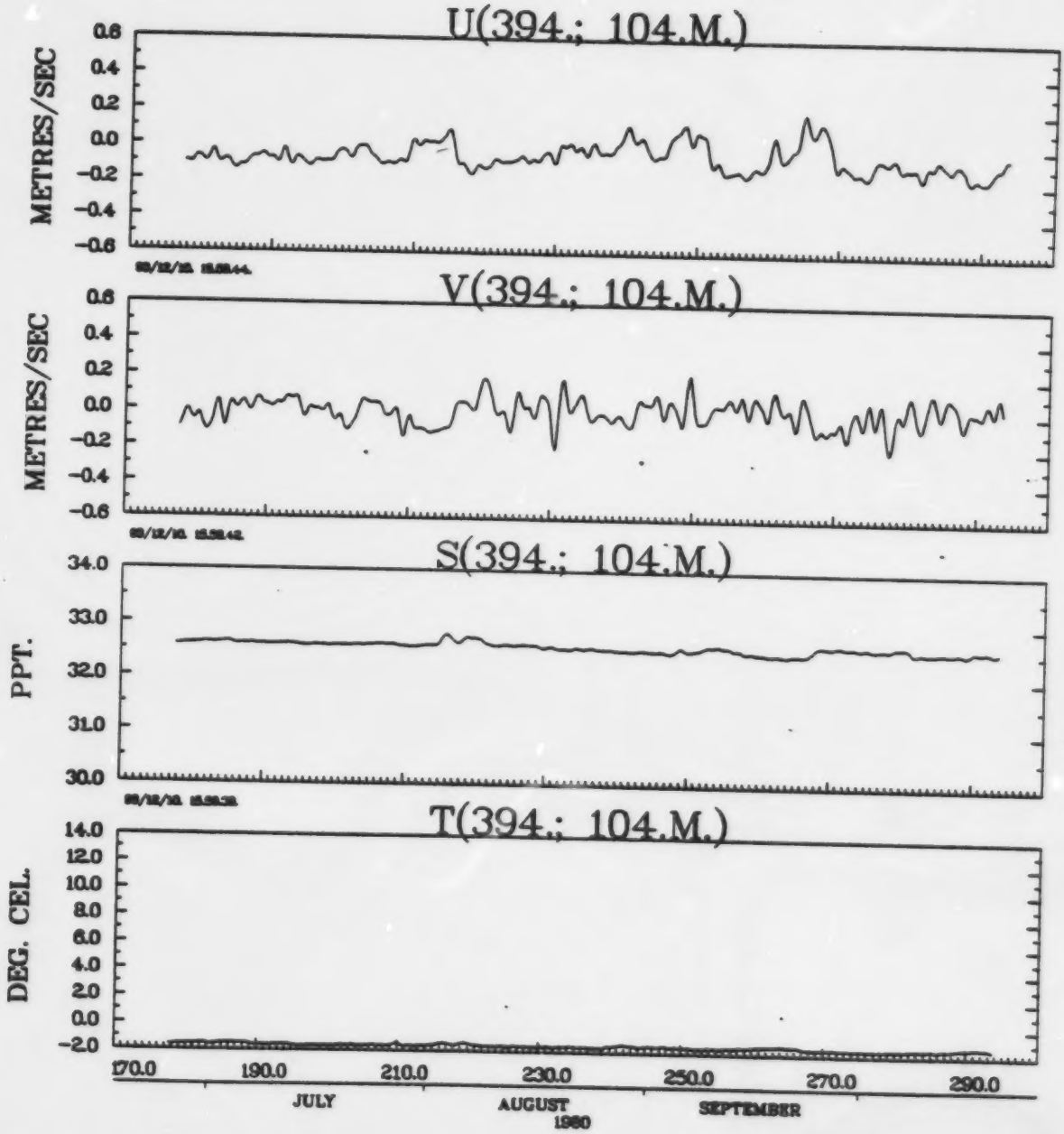
STN. 394, 104 M.



AVALON CHANNEL CURRENTS

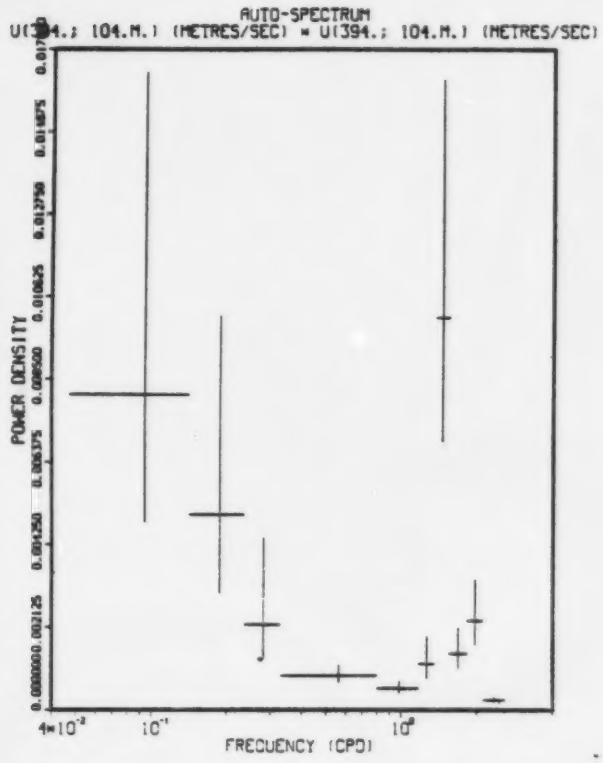


AP2(394.; 104) AVALON CHANNEL JUNE 21-OCT.23/80

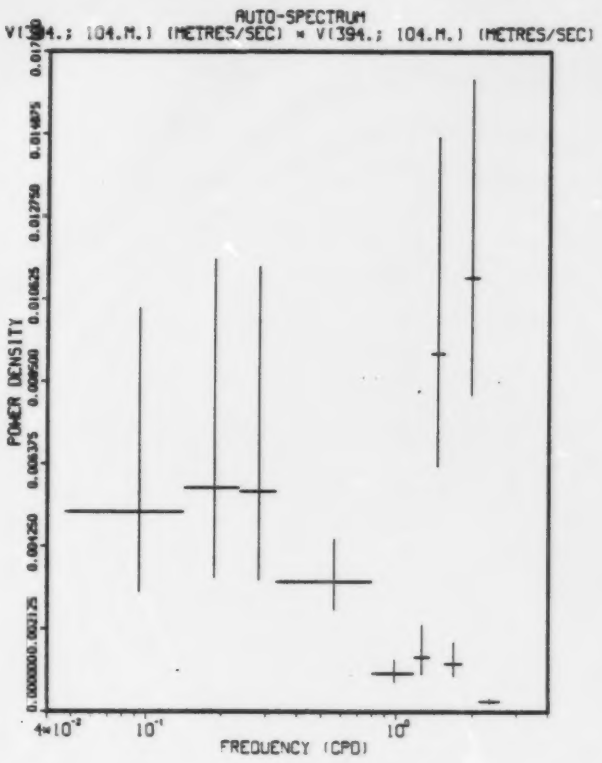


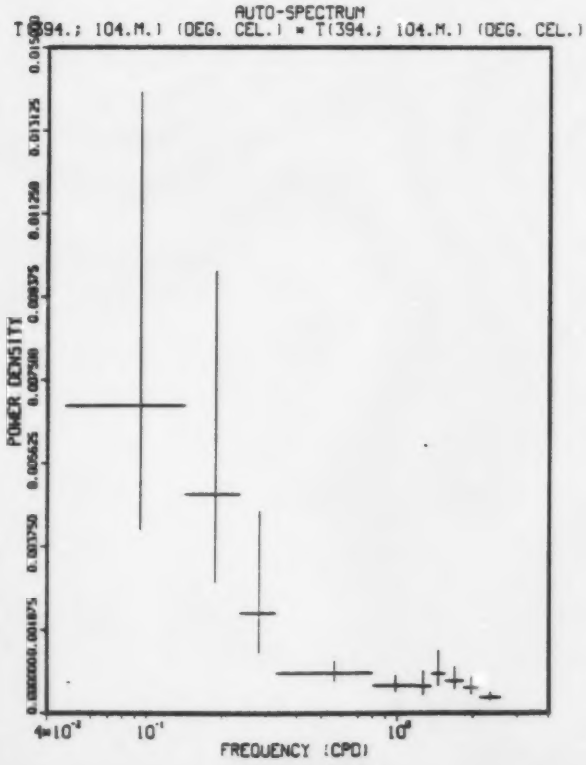
AP2(394.; 104) AVALON CHANNEL JUNE 21-OCT.23/80

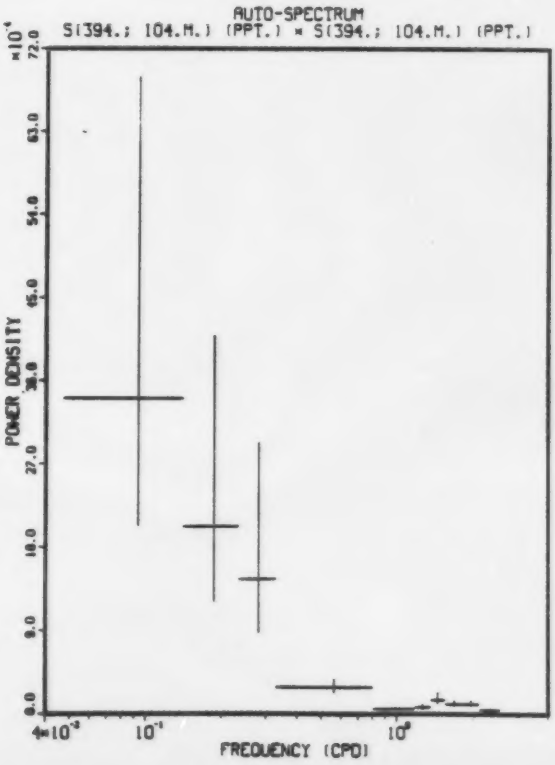
AP2(394.; 104) AVALON CHANNEL JUNE 21-OCT.23/80



AP2(394.; 104) AVALON CHANNEL JUNE 21-OCT.23/80







MOORING 395

DEPTH (M) 30

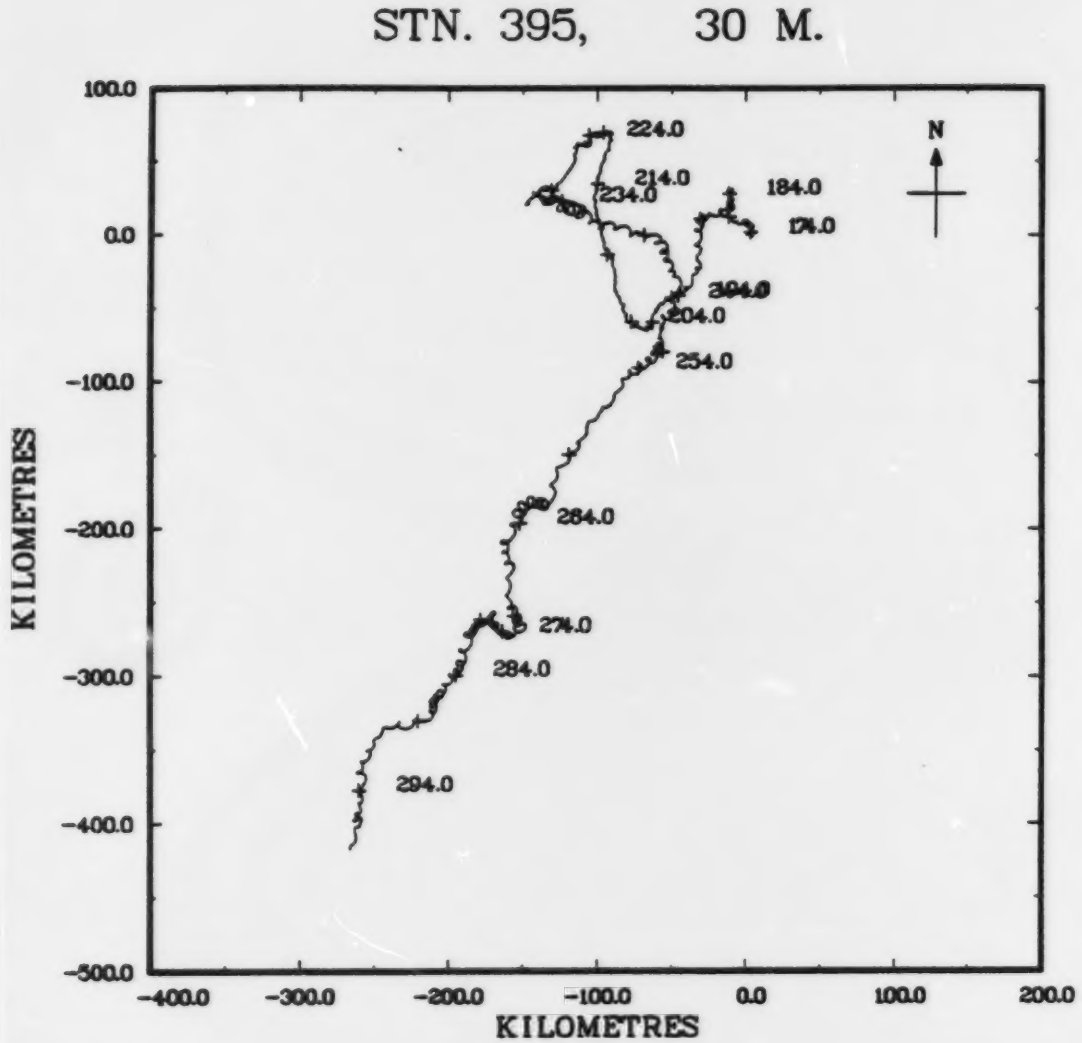
INSTRUMENT TYPE/SERIAL NUMBER	AANDERAA RCM4 1286
LATITUDE	47 21.45 N
LONGITUDE	52 00.07 W
WATER DEPTH (M)	164
MOORING DATE/CRUISE	21/ 6/1980 80019
DURATION (DAYS)	123.7
SAMPLE INTERVAL (MINUTES)	30

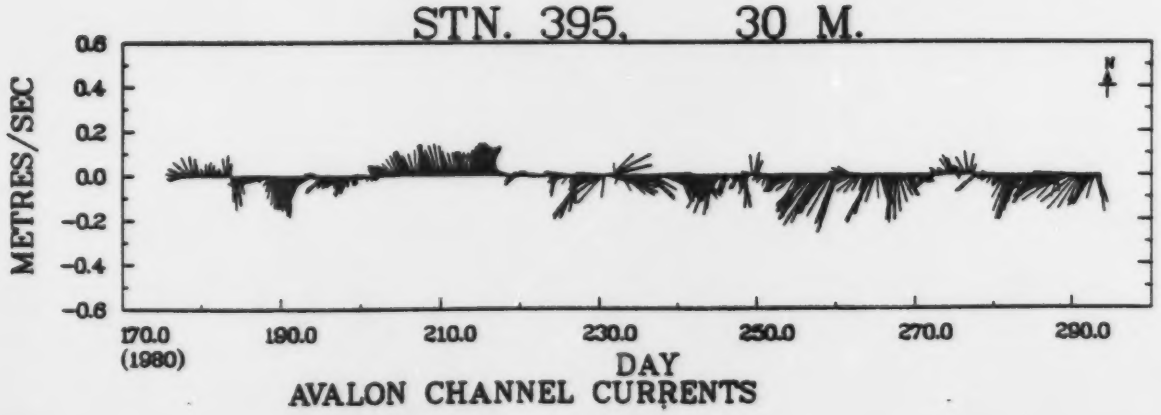
VARIABLE (UNITS)	MEAN	MIN	MAX	STD. DEV.	SAMPLES
E COMP VEL(M/S)	-.025	-.594	.776	.165	5937
N COMP VEL(M/S)	-.039	-.799	.800	.173	5937
TEMPERATURE (^{o}C)	4.82	-.92	10.07	3.43	5937
SALINITY	31.97	30.85	32.95	.55	5937

LOW PASS FILTER SAMPLE INTERVAL 6H

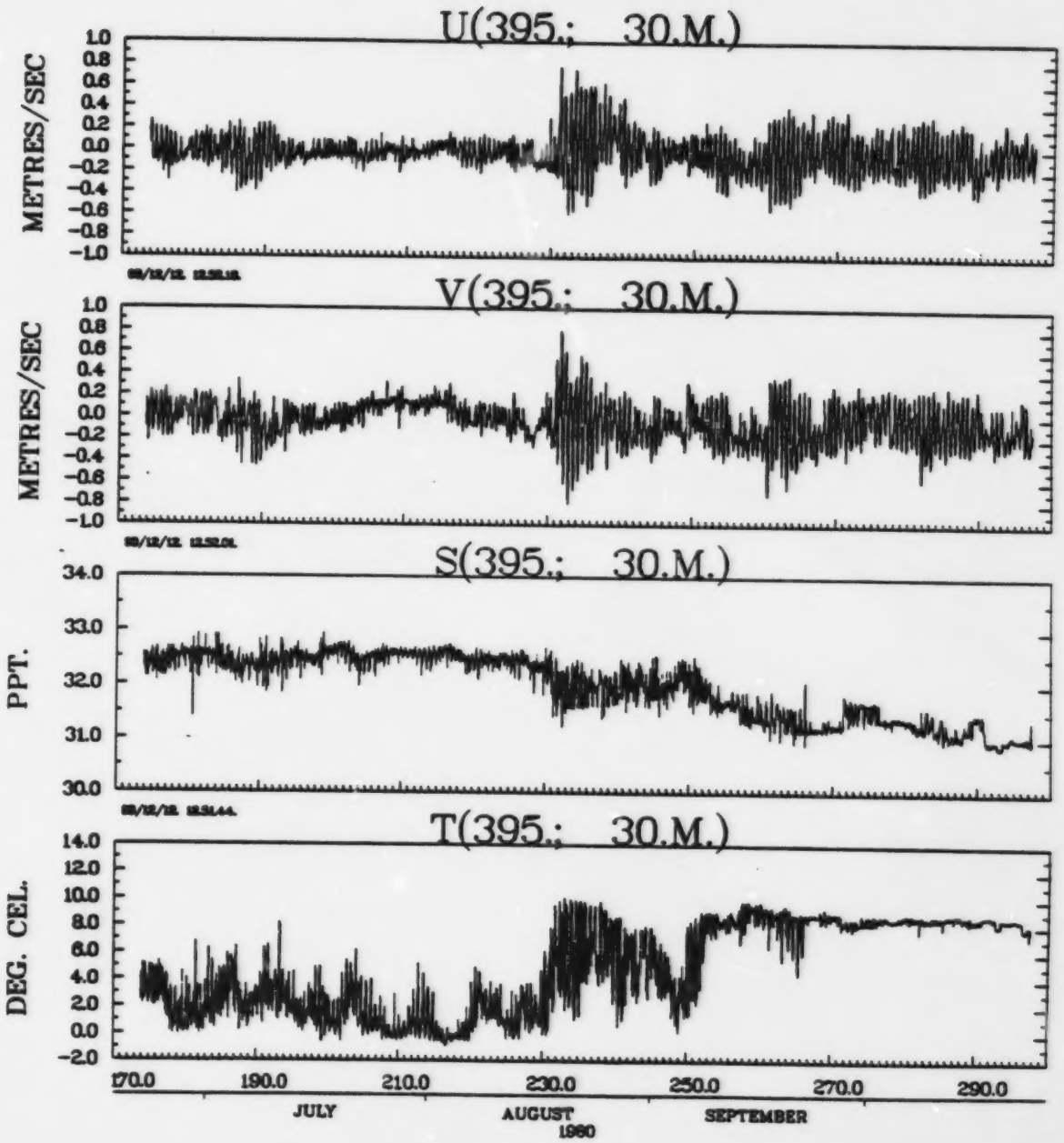
	E VELOCITY	N VELOCITY	TEMPERATURE	SALINITY
MEAN	-.026	-.038	4.74	31.99
STD. DEV.	.065	.085	3.31	.52

COMMENTS

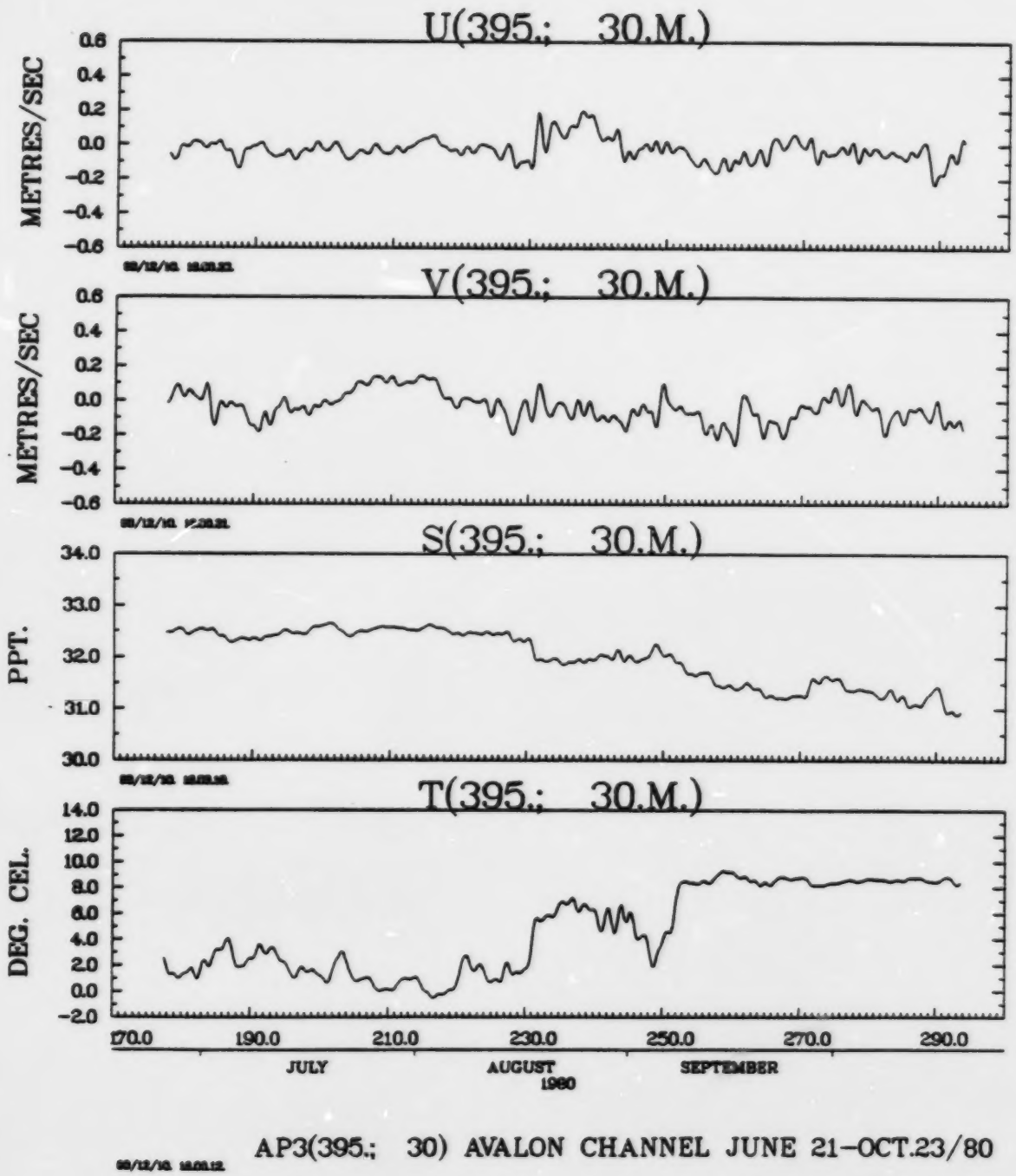




AVALON CHANNEL CURRENTS



AP3(395.; 30) AVALON CHANNEL JUNE 21–OCT.23/80



AP3(395.; 30) AVALON CHANNEL JUNE 21–OCT.23/80

AP3(395.: 30) AVALON CHANNEL JUNE 21-OCT.23/80

AP3(395.: 30) AVALON CHANNEL JUNE 21-OCT.23/80

AUTO-SPECTRUM

U(395.: 30.M.) (METRES/SEC) * U(395.: 30.M.) (METRES/SEC)

POWER DENSITY

0.00000 0.01875 0.03750 0.05625 0.07500 0.09375 0.11250 0.13125

$4*10^{-2}$ 10^{-1} 10^{0}

FREQUENCY (CPD)

AUTO-SPECTRUM

V(395.: 30.M.) (METRES/SEC) * V(395.: 30.M.) (METRES/SEC)

POWER DENSITY

0.0000 0.0175 0.0350 0.0525 0.0700 0.0875 0.1050 0.1225

$4*10^{-2}$ 10^{-1} 10^{0}

FREQUENCY (CPD)

AUTO-SPECTRUM

T(395.: 30.M.) (DEG. CEL.) * T(395.: 30.M.) (DEG. CEL.)

POWER DENSITY

0.0 0.7 1.4 2.1 2.8 3.5 4.2 4.9

$4*10^{-2}$ 10^{-1} 10^{0}

FREQUENCY (CPD)

AUTO-SPECTRUM

S(395.: 30.M.) (PPT.) * S(395.: 30.M.) (PPT.)

POWER DENSITY

0.00000 0.00775 0.01550 0.02325 0.03100 0.03875 0.04650 0.05425 0.06200

$4*10^{-2}$ 10^{-1} 10^{0}

FREQUENCY (CPD)

MOORING 395

DEPTH (M) 80

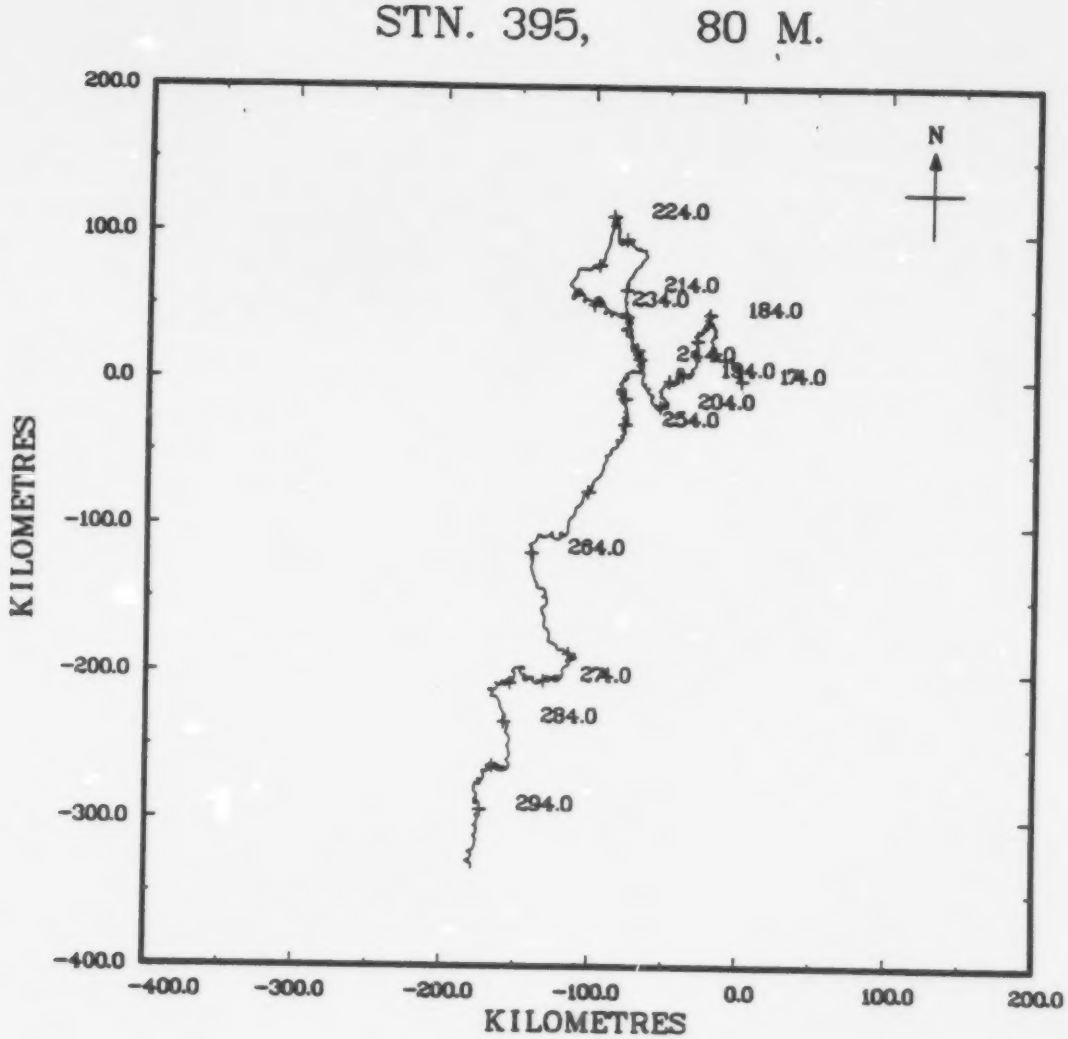
INSTRUMENT TYPE/SERIAL NUMBER	AANDERAA RCM4 1287
LATITUDE	47 21.45 N
LONGITUDE	52 00.07 W
WATER DEPTH (M)	164
MOORING DATE/CRUISE	21/ 6/1980 80019
DURATION (DAYS)	123.7
SAMPLE INTERVAL (MINUTES)	30

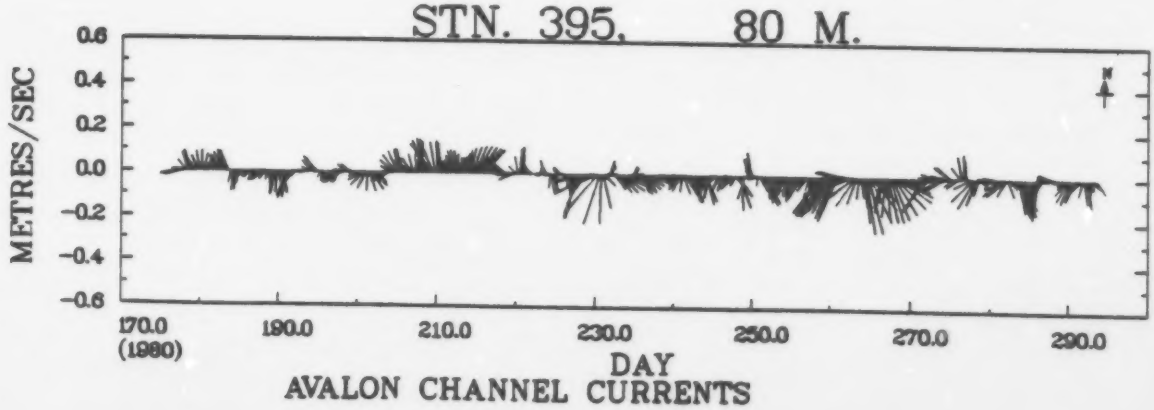
VARIABLE (UNITS)	MEAN	MIN	MAX	STD. DEV.	SAMPLES
E COMP VEL(M/S)	-.017	-.304	.299	.106	5936
N COMP VEL(M/S)	-.031	-.296	.279	.120	5936
TEMPERATURE (^{o}C)	-1.43	-1.70	-.68	.17	5936
SALINITY	32.91	32.66	33.06	.06	5936

LOW PASS FILTER SAMPLE INTERVAL 6H

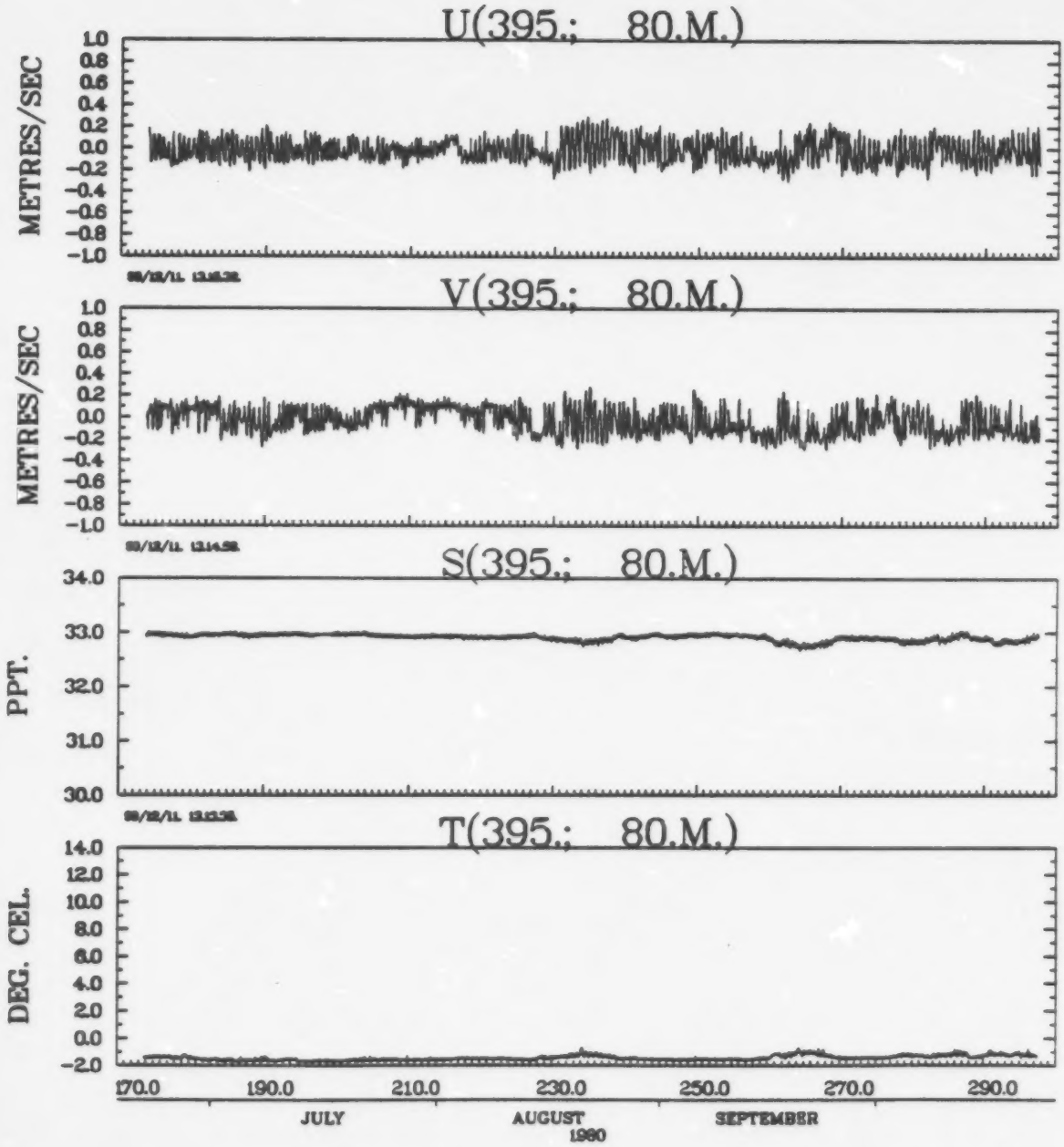
	E VELOCITY	N VELOCITY	TEMPERATURE	SALINITY
MEAN	-.016	-.030	-1.44	32.91
STD. DEV.	.051	.081	.16	.05

COMMENTS

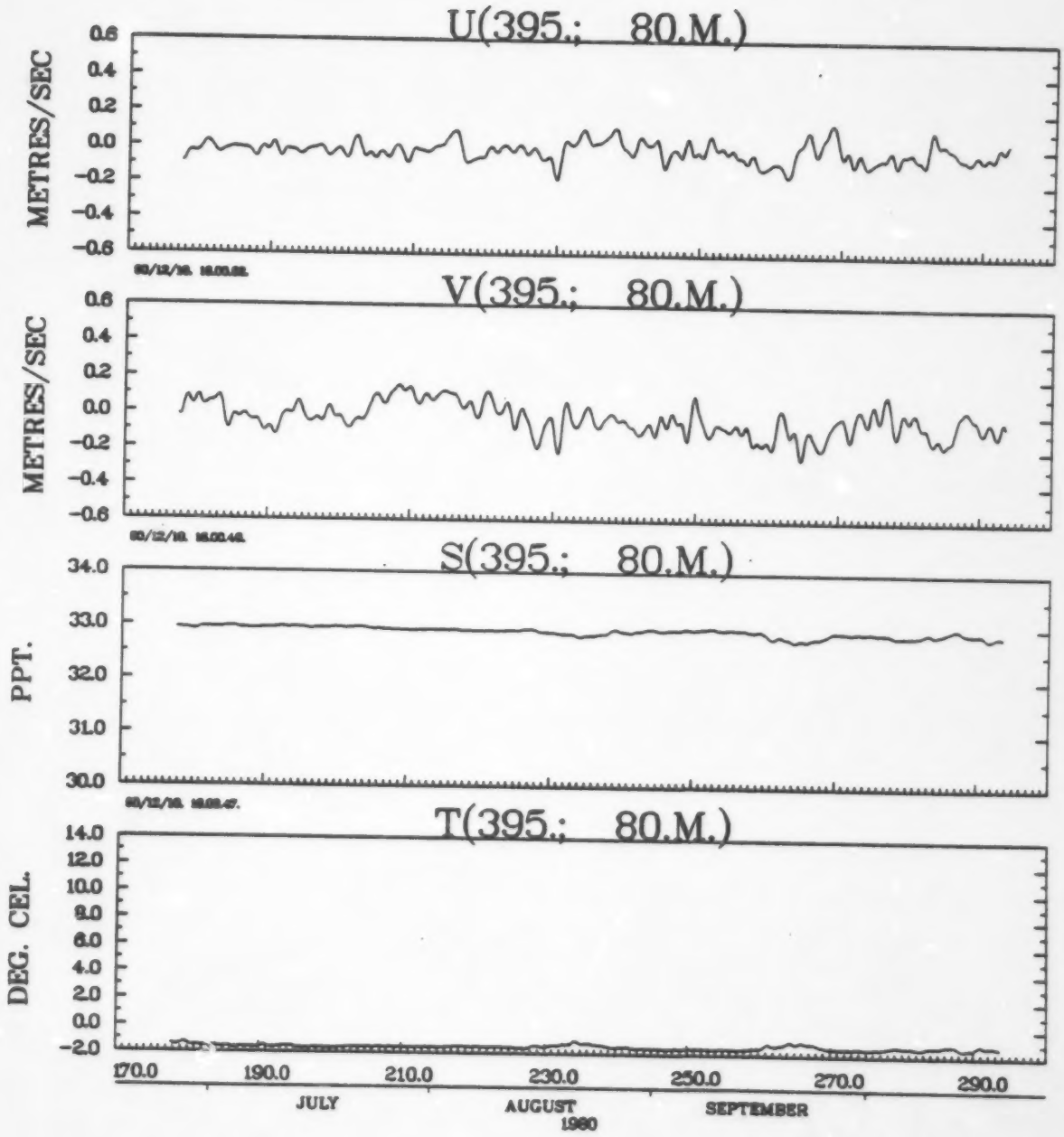




AVALON CHANNEL CURRENTS



AP3(395.; 80) AVALON CHANNEL JUNE 21–OCT.23/80

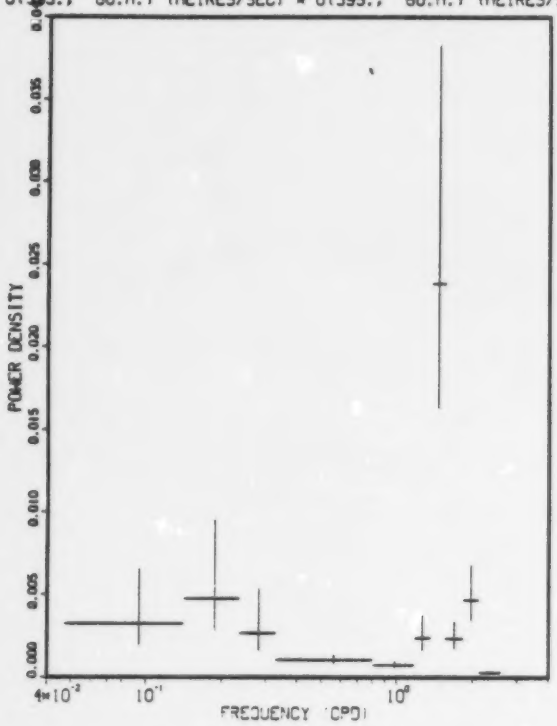


AP3(395.; 80) AVALON CHANNEL JUNE 21–OCT.23/80

AP3(395.; 80) AVALON CHANNEL JUNE 21-OCT.23/80

AUTO-SPECTRUM

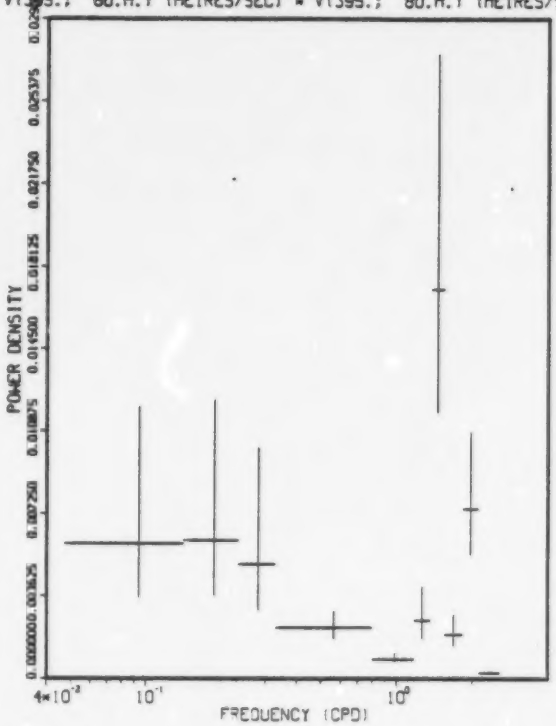
U(395.; 80.M.) (METRES/SEC) * U(395.; 80.M.) (METRES/SEC)



AP3(395.; 80) AVALON CHANNEL JUNE 21-OCT.23/80

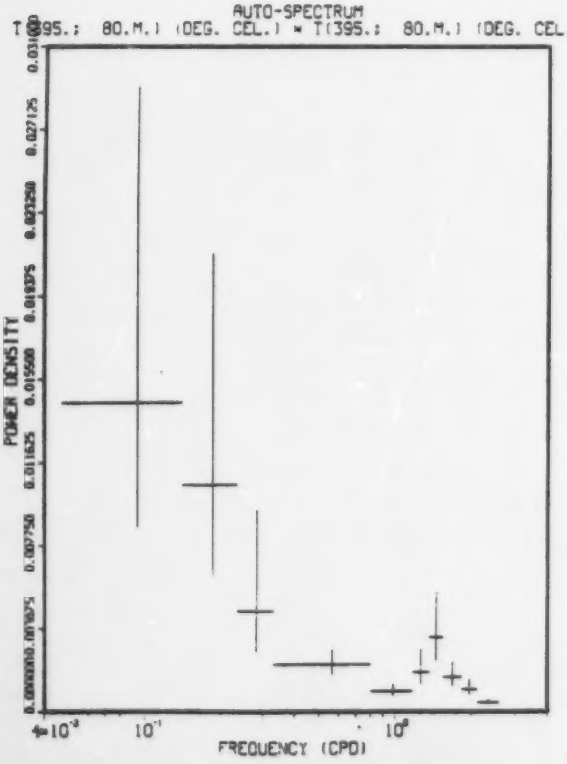
AUTO-SPECTRUM

V(395.; 80.M.) (METRES/SEC) * V(395.; 80.M.) (METRES/SEC)



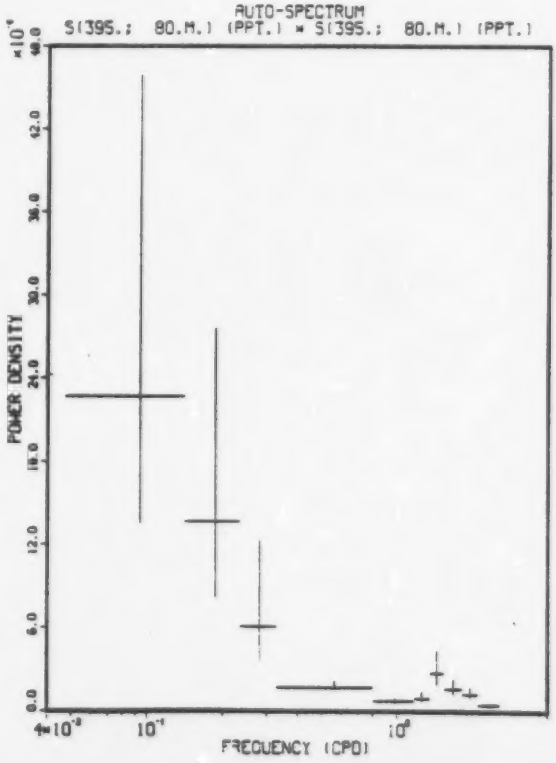
AUTO-SPECTRUM

T(395.; 80.M.) (DEG. CEL.) * T(395.; 80.M.) (DEG. CEL.)



AUTO-SPECTRUM

S(395.; 80.M.) (PPT.) * S(395.; 80.M.) (PPT.)



MOORING 395

DEPTH (M) 130

INSTRUMENT TYPE/SERIAL NUMBER	AANDERAA RCM4 1900
LATITUDE	47 21.45 N
LONGITUDE	52 00.07 W
WATER DEPTH (M)	164
MOORING DATE/CRUISE	21/ 6/1980 80019
DURATION (DAYS)	123.7
SAMPLE INTERVAL (MINUTES)	30

VARIABLE (UNITS)	MEAN	MIN	MAX	STD. DEV.	SAMPLES
E COMP VEL(M/S)	-.006	-.277	.314	.088	5937
N COMP VEL(M/S)	-.031	-.368	.283	.101	5937
TEMPERATURE (^{o}C)					
SALINITY					

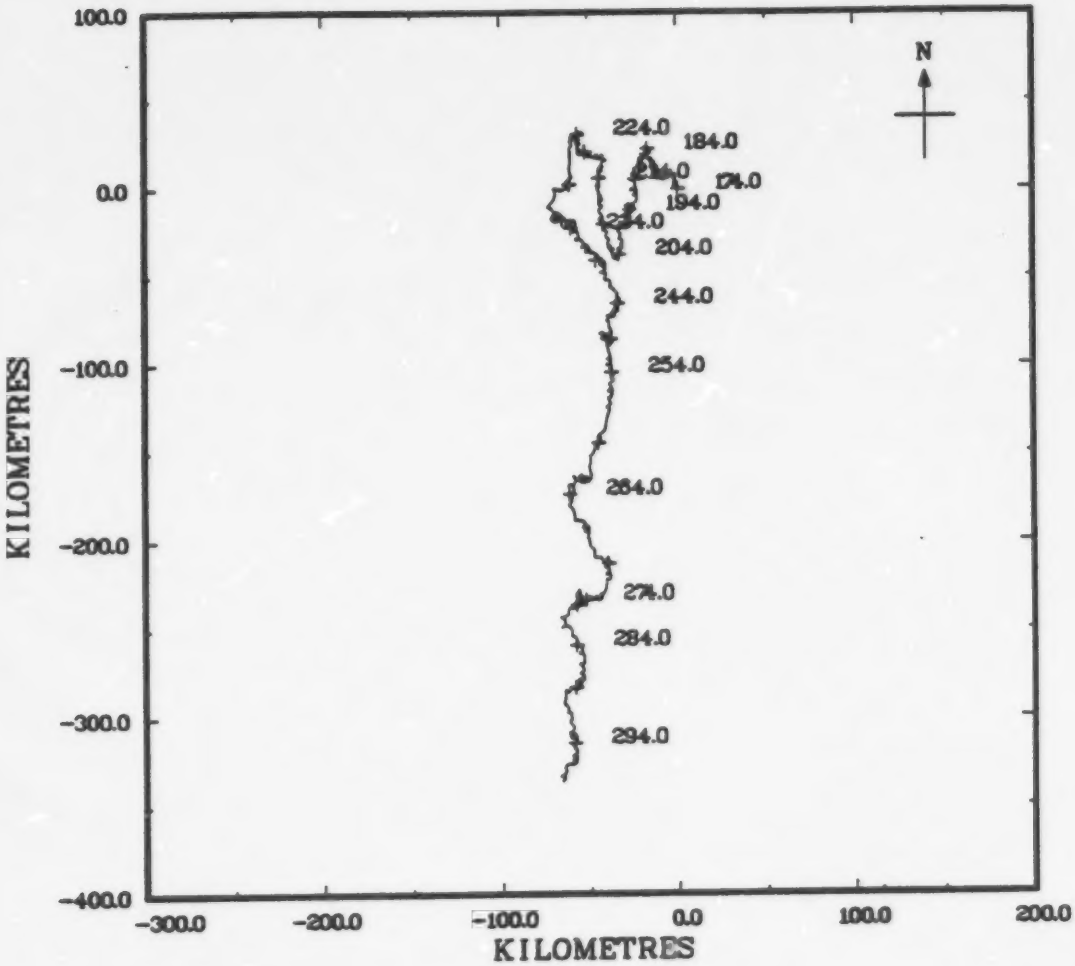
LOW PASS FILTER SAMPLE INTERVAL 6H

	E VELOCITY	N VELOCITY	TEMPERATURE	SALINITY
MEAN	-.006	-.032		
STD. DEV.	.033	.058		

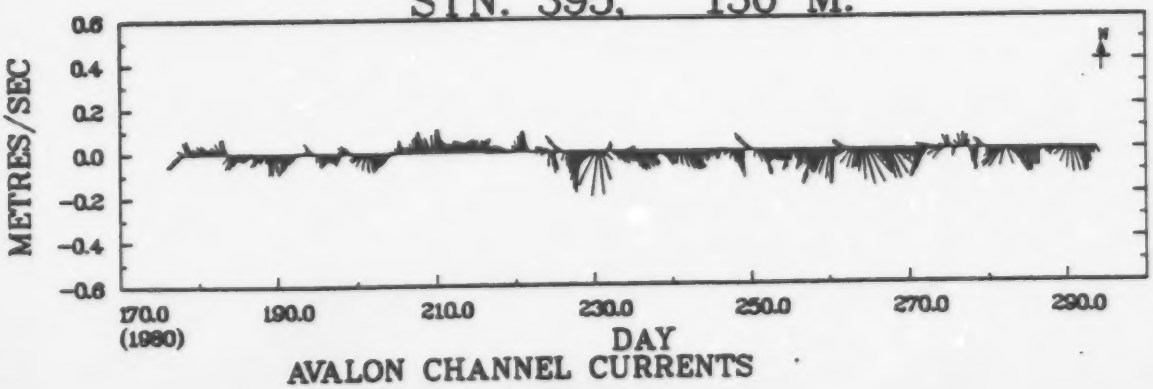
COMMENTS

TEMPERATURE SENSOR FAILED

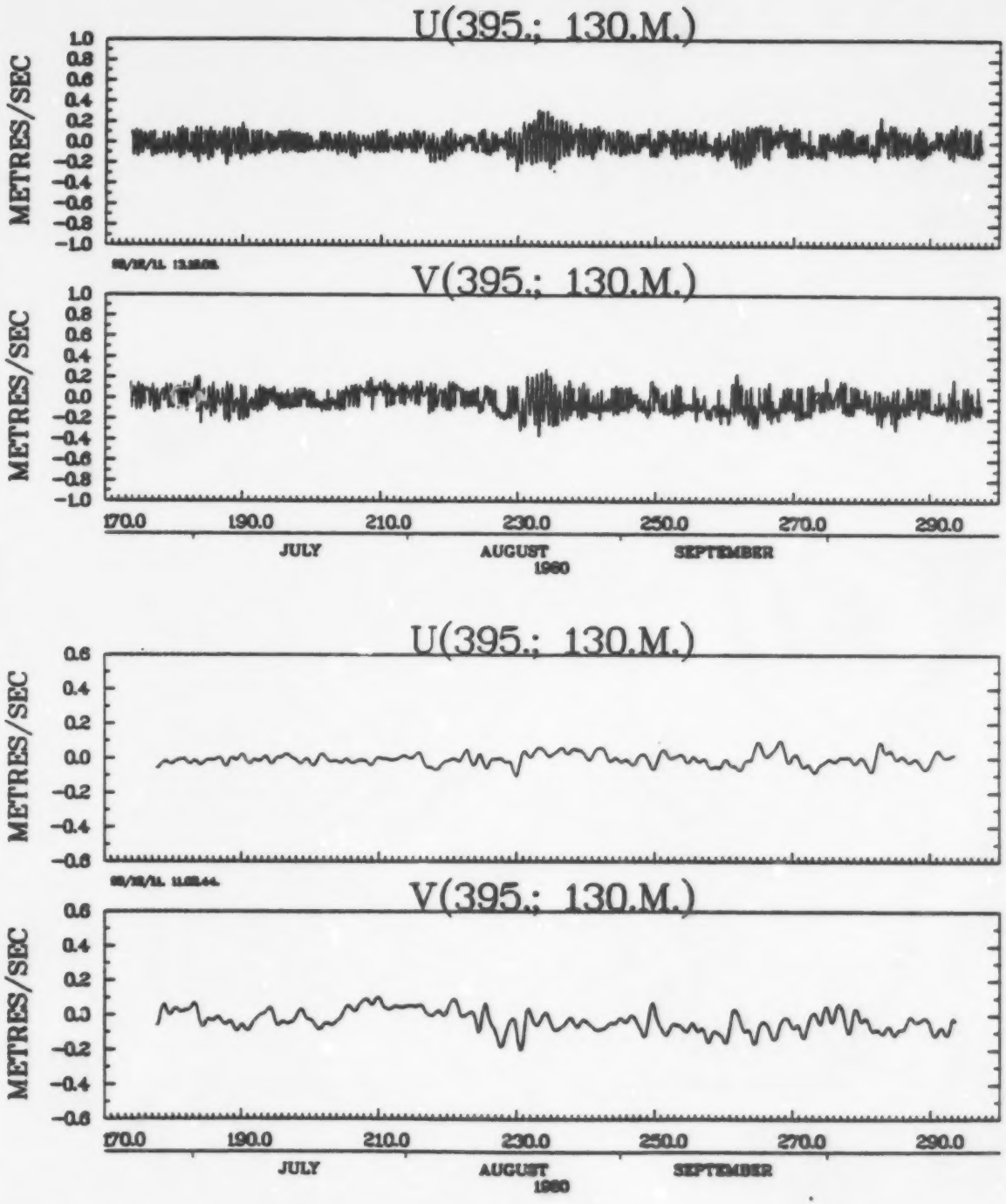
STN. 395, 130 M.



STN. 395, 130 M.

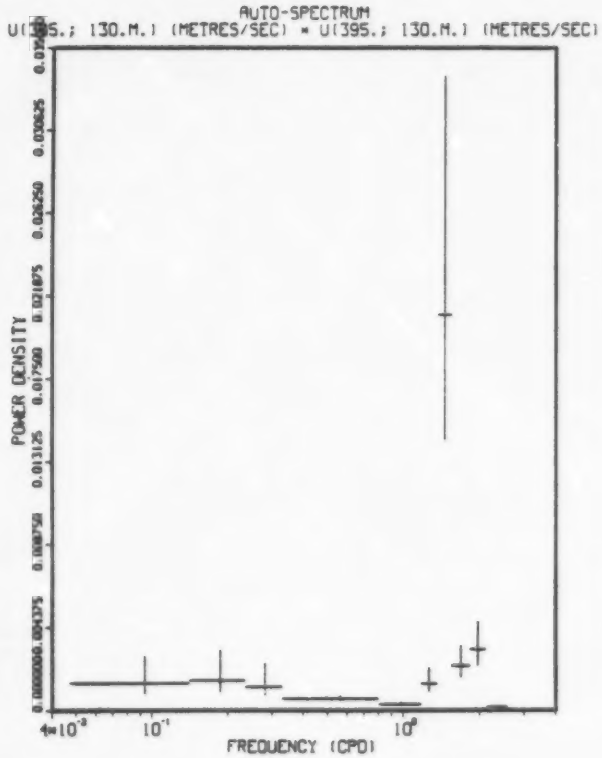


AVALON CHANNEL CURRENTS

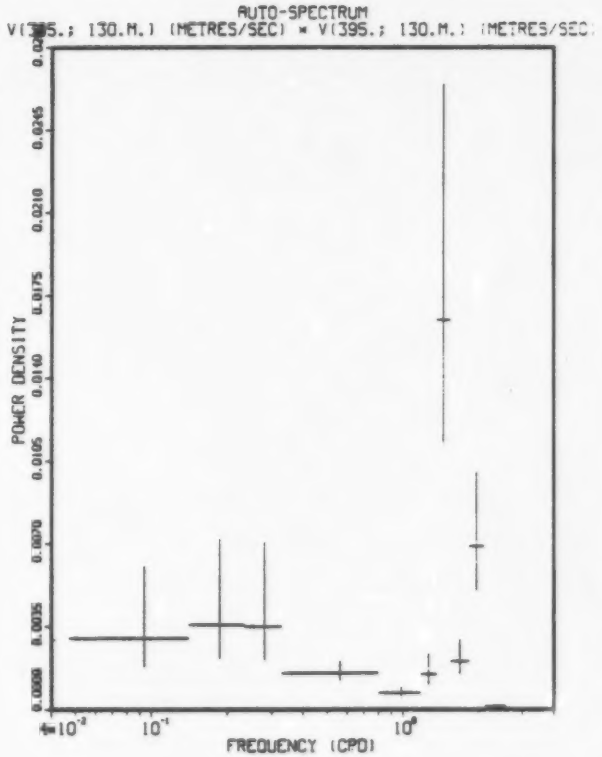


AP3(395.; 130.M.) AVALON CHANNEL JUNE 21–OCT.23/80

AP3(395.; 130.M.) AVALON CHANNEL JUNE 21-OCT.23/80



AP3(395.; 130.M.) AVALON CHANNEL JUNE 21-OCT.23/80



MOORING 429

DEPTH (M) 38

INSTRUMENT TYPE/SERIAL NUMBER	AANDERAA RCM4 818
LATITUDE	47 30.06 N
LONGITUDE	52 34.96 W
WATER DEPTH (M)	175
MOORING DATE/CRUISE	23/ 10/1980 80033
DURATION (DAYS)	181.8
SAMPLE INTERVAL (MINUTES)	60

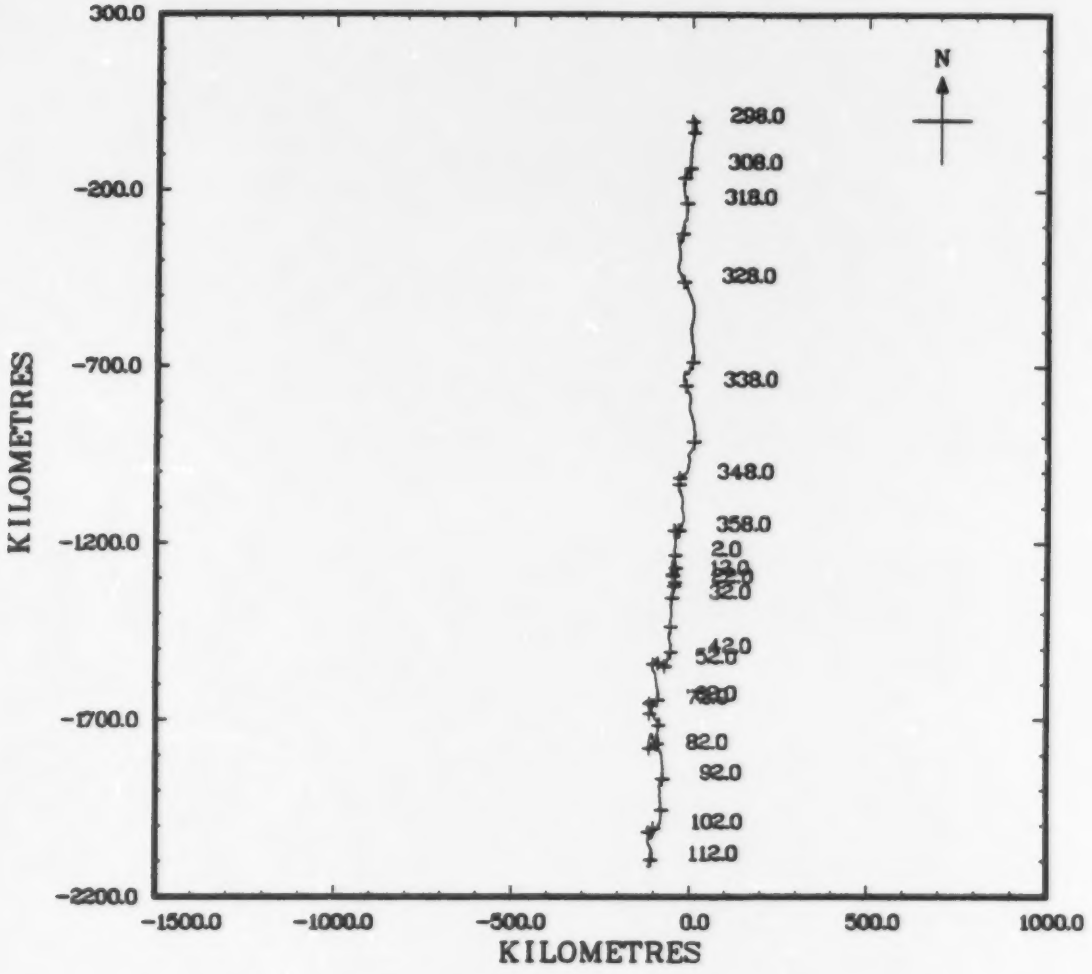
VARIABLE (UNITS)	MEAN	MIN	MAX	STD. DEV.	SAMPLES
E COMP VEL(M/S)	-.007	-.279	.369	.088	4364
N COMP VEL(M/S)	-.135	-1.43	.500	.209	4364
TEMPERATURE (^{o}C)	.98	-1.67	8.11	2.25	4363
SALINITY	31.98	30.96	32.53	.34	4363

LOW PASS FILTER SAMPLE INTERVAL 6H

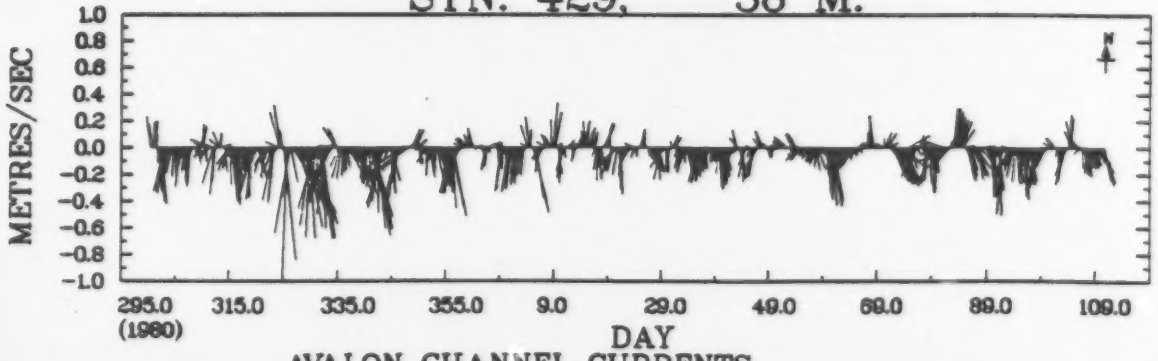
	E VELOCITY	N VELOCITY	TEMPERATURE	SALINITY
MEAN	-.007	-.135	.90	31.99
STD. DEV.	.065	.184	2.13	.32

COMMENTS

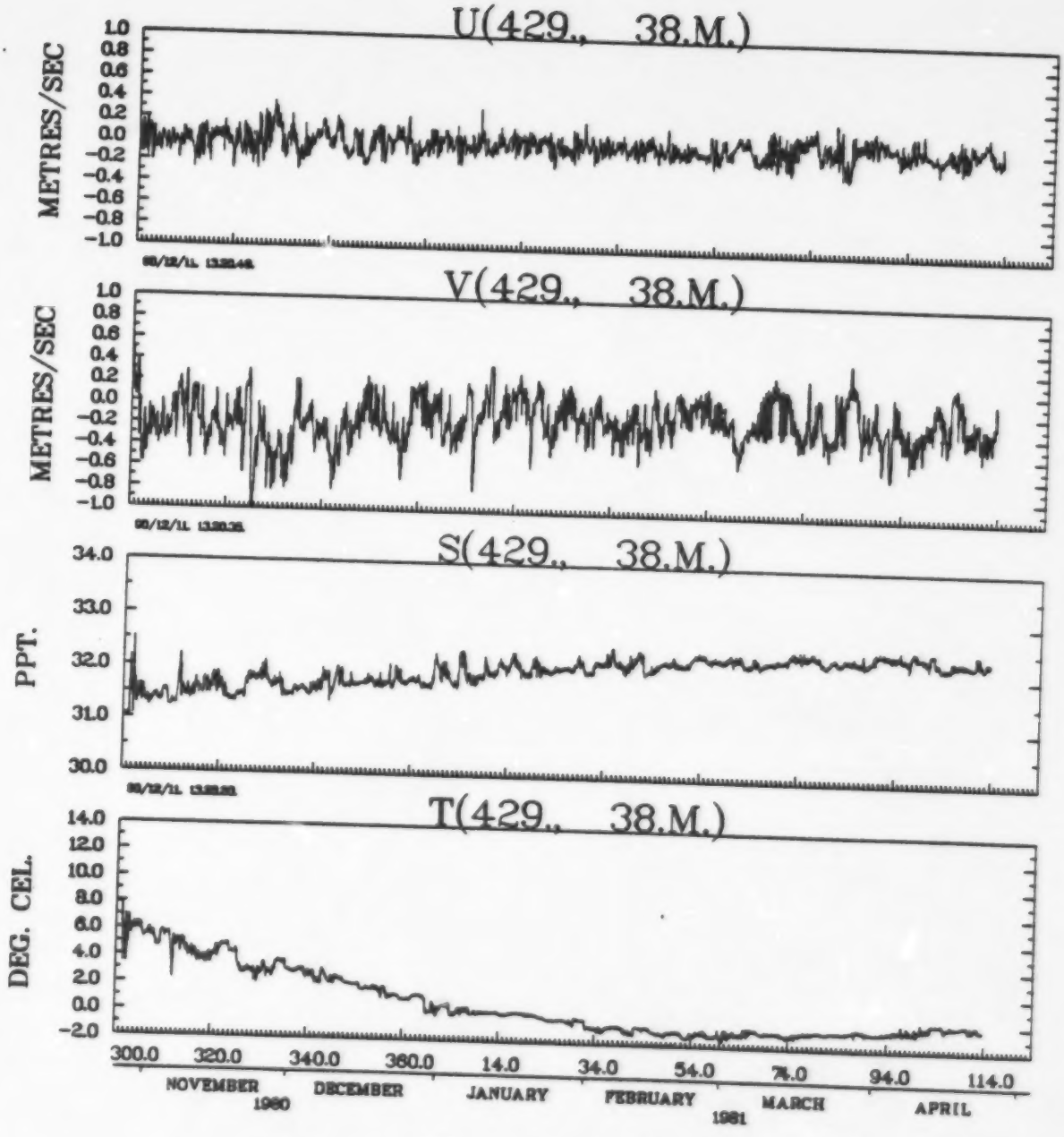
STN. 429, 38 M.



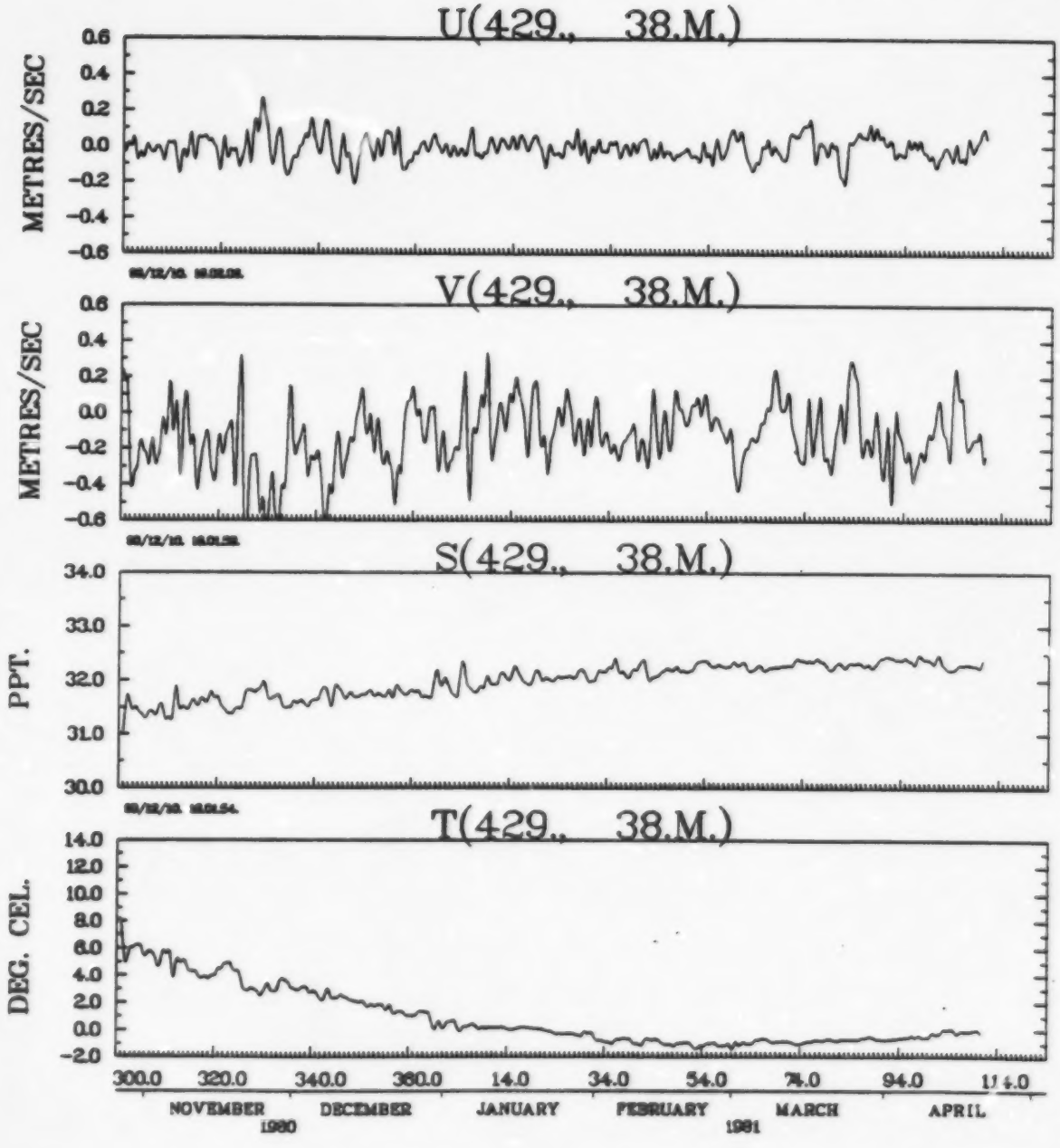
STN. 429, 38 M.



AVALON CHANNEL CURRENTS



AP1(429.; 38) AVALON CHANNEL
OCT.23/80-APR.23/81



AP1(429.; 38) AVALON CHANNEL
OCT.23/80-APR.23/81

AP:(429.: 38) AVALON CHANNEL OCT.23/80-APR.23/81

AUTO-SPECTRUM

U(429., 38.M.) (METRES/SEC) * U(429., 38.M.) (METRES/SEC)

POWER DENSITY

FREQUENCY (CPD)

AP:(429.: 38) AVALON CHANNEL OCT.23/80-APR.23/81

AUTO-SPECTRUM

V(429., 38.M.) (METRES/SEC) * V(429., 38.M.) (METRES/SEC)

POWER DENSITY

FREQUENCY (CPD)

AUTO-SPECTRUM

T(429., 38.M.) (DEG. CEL.) * T(429., 38.M.) (DEG. CEL.)

POWER DENSITY

FREQUENCY (CPD)

AUTO-SPECTRUM

S(429., 38.M.) (PPT.) * S(429., 38.M.) (PPT.)

POWER DENSITY

FREQUENCY (CPD)

MOORING 429

DEPTH (M) 117

INSTRUMENT TYPE/SERIAL NUMBER	AANDERAA RCM4 822
LATITUDE	47 30.06 N
LONGITUDE	52 34.96 W
WATER DEPTH (M)	175
MOORING DATE/CRUISE	23/10/1980 80033
DURATION (DAYS)	181.8
SAMPLE INTERVAL (MINUTES)	60

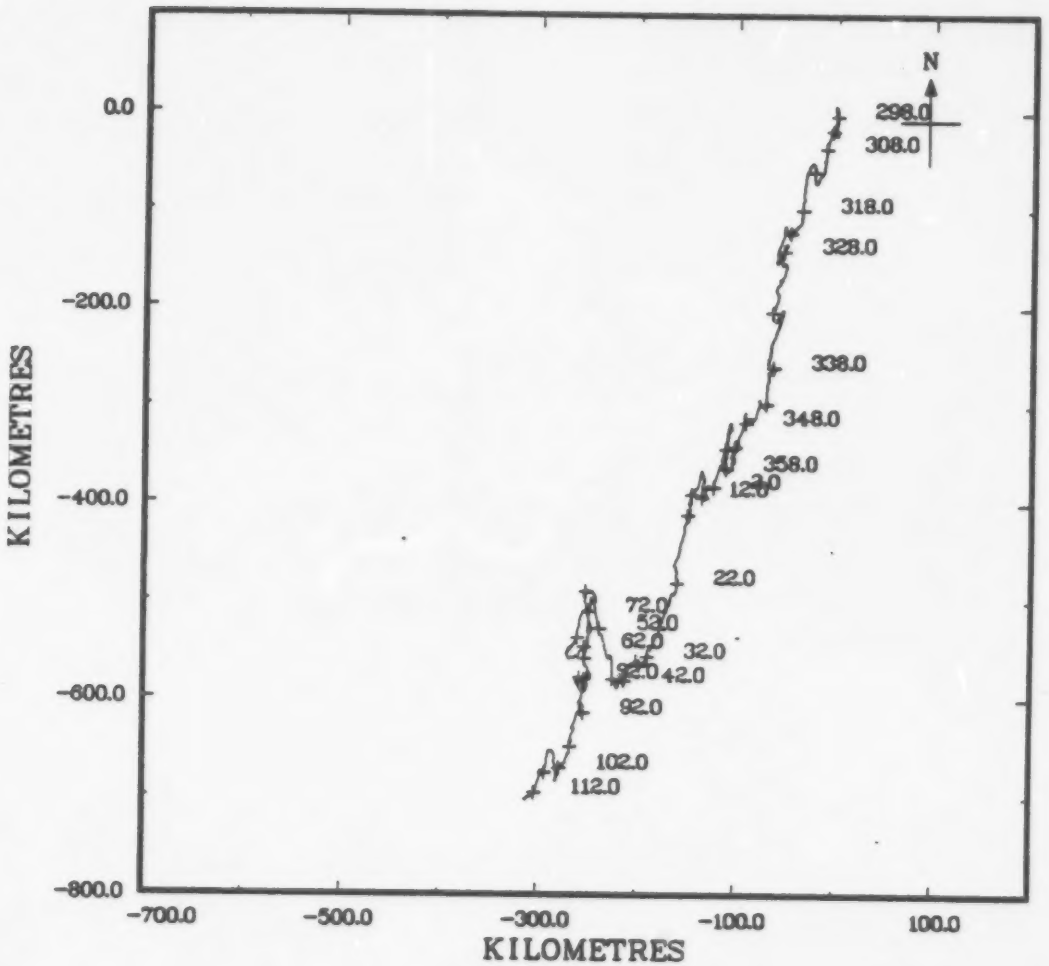
VARIABLE (UNITS)	MEAN	MIN	MAX	STD. DEV.	SAMPLES
E COMP VEL(M/S)	-.020	-.278	.269	.068	4361
N COMP VEL(M/S)	-.045	-.695	.506	.152	4361
TEMPERATURE (^{o}C)	-.60	-1.53	3.52	.57	4361
SALINITY	32.66	31.22	33.38	.19	4361

LOW PASS FILTER SAMPLE INTERVAL 6H

	E VELOCITY	N VELOCITY	TEMPERATURE	SALINITY
MEAN	-.019	-.045	-.58	32.66
STD. DEV.	.042	.125	.54	.17

COMMENTS

STN. 429, 117 M.



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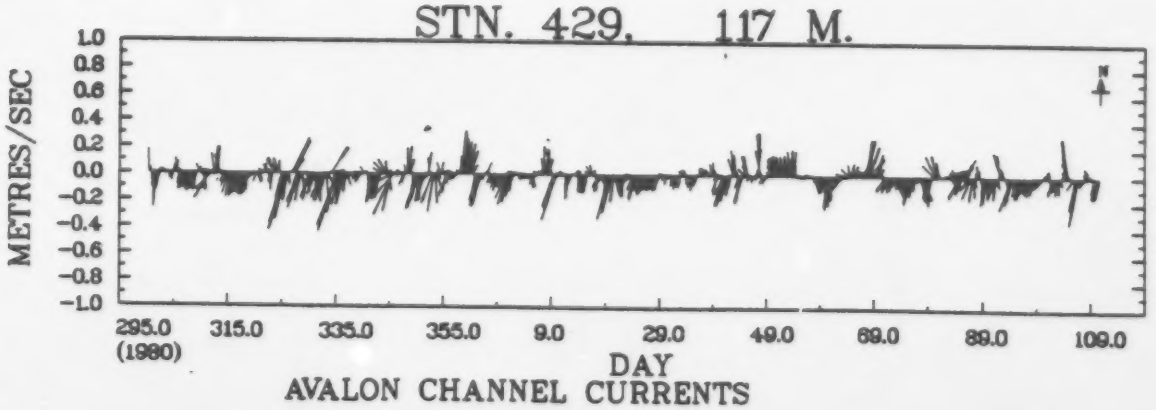
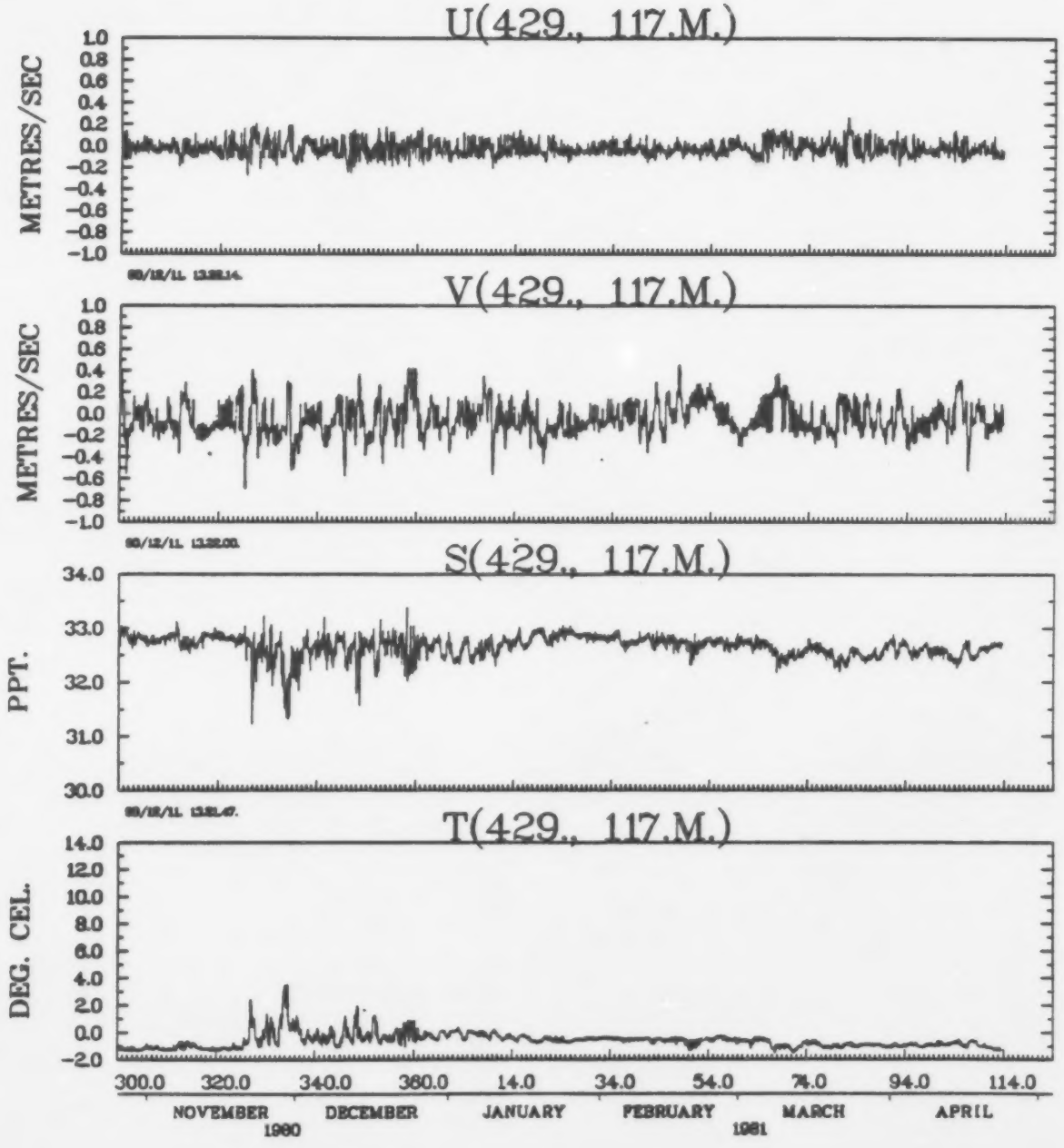
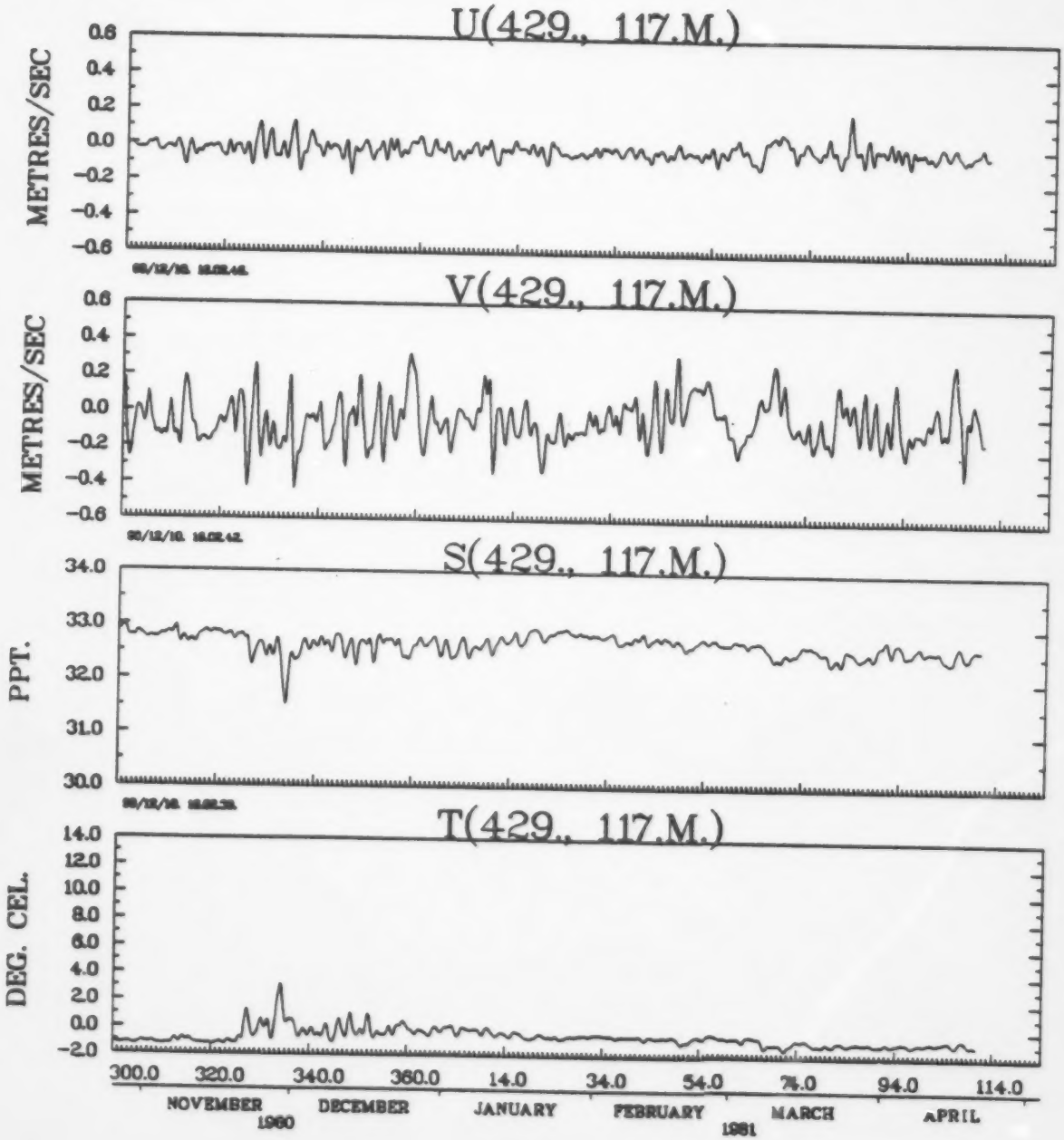


AVALON CHANNEL CURRENTS

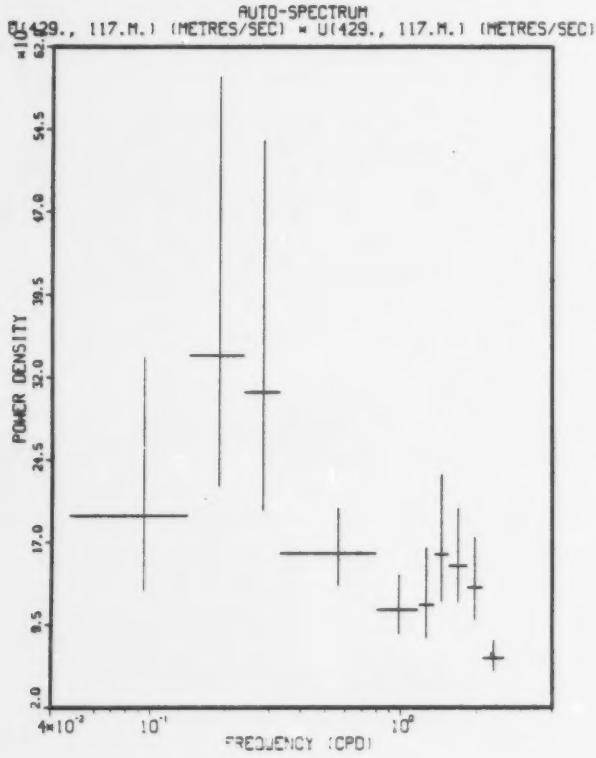


AP1(429.; 117) AVALON CHANNEL
OCT.23/80-APR.23/81

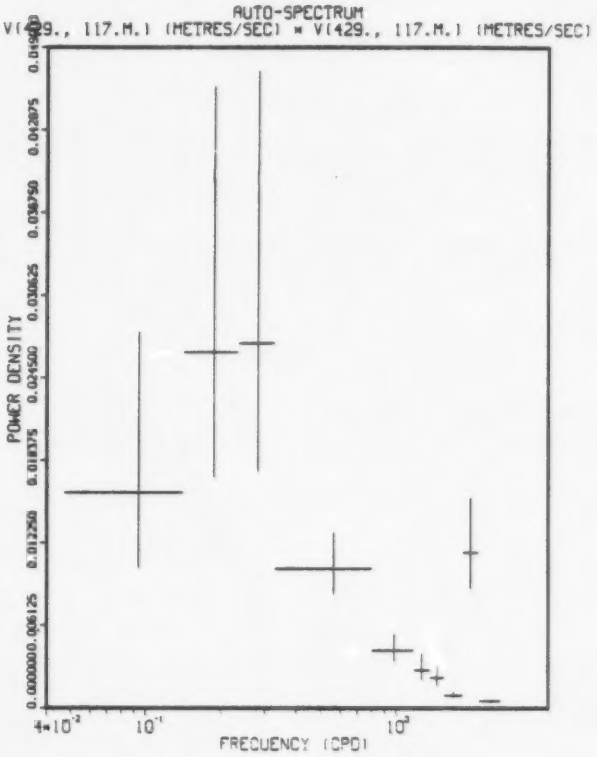


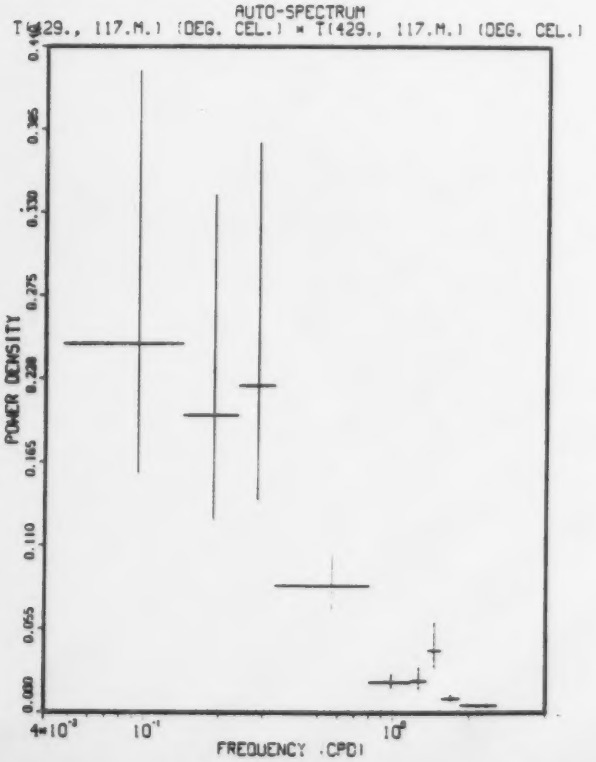
AP1(429.; 117) AVALON CHANNEL
OCT.23/80-APR.23/81

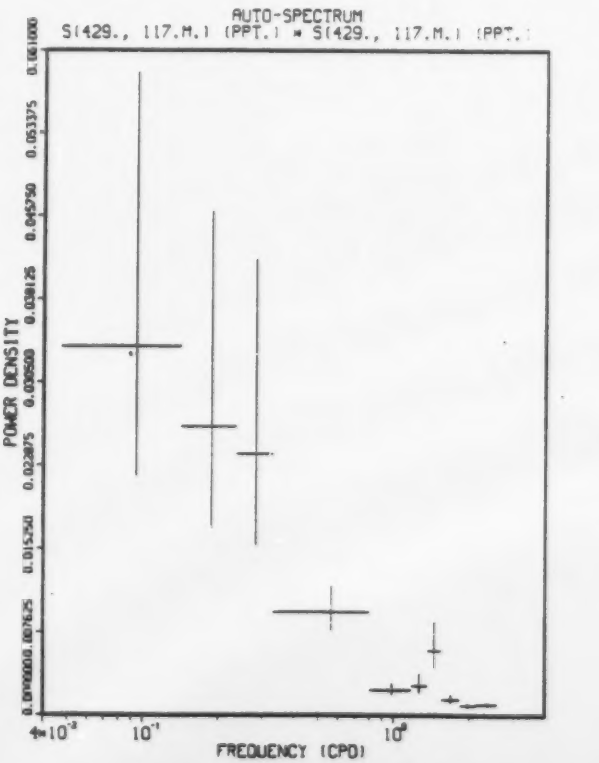
AP1(429.; 117) AVALON CHANNEL OCT.23/80-APR.23/81



AP1(429.; 117) AVALON CHANNEL OCT.23/80-APR.23/81







MOORING 393

DEPTH (M) 174

INSTRUMENT TYPE/SERIAL NUMBER	AANDERAA TG4A 282
LATITUDE	47 30.00 N
LONGITUDE	52 34.80 W
WATER DEPTH (M)	175
MOORING DATE/CRUISE	21/ 6/1980 80019
DURATION (DAYS)	123.7
SAMPLE INTERVAL (MINUTES)	60

VARIABLE (UNITS)	MEAN	MIN	MAX	STD. DEV.	SAMPLES
PRESSURE (MBAR)	75.76	0.0	162.0	30.78	2966
TEMPERATURE (^{o}C)	-.62	-1.03	.05	.22	2966

LOW PASS FILTER SAMPLE INTERVAL 6H

	PRESSURE	TEMPERATURE
MEAN	75.60	-.62
STD. DEV.	5.84	.22

COMMENTS

DATA WERE PROCESSED BY TIDAL SECTION SO THAT THE HIGHEST OBSERVED VALUE WAS SET EQUAL TO ZERO AND ALL OTHERS WERE CALCULATED AS (HIGHEST - OBSERVATION)

MOORING 394

DEPTH (M) 161

INSTRUMENT TYPE/SERIAL NUMBER	AANDERAA WLR5 044
LATITUDE	47 16.20 N
LONGITUDE	51 36.00 W
WATER DEPTH (M)	162
MOORING DATE/CRUISE	21/ 6/1980 80019
DURATION (DAYS)	123.7
SAMPLE INTERVAL (MINUTES)	60

VARIABLE (UNITS)	MEAN	MIN	MAX	STD. DEV.	SAMPLES
PRESSURE (MBAR)	74.39	0.0	162.0	30.55	2964
TEMPERATURE (^{o}C)	-.80	-1.33	.21	.32	2964

LOW PASS FILTER SAMPLE INTERVAL 6H

	PRESSURE	TEMPERATURE
MEAN	74.29	-.80
STD. DEV.	5.92	.32

COMMENTS

DATA WERE PROCESSED BY TIDAL SECTION SO THAT THE HIGHEST OBSERVED VALUE WAS SET EQUAL TO ZERO AND ALL OTHERS WERE CALCULATED AS (HIGHEST - OBSERVATION)

MOORING 396

DEPTH (M) 152

INSTRUMENT TYPE/SERIAL NUMBER	AANDERAA TG4A 281
LATITUDE	47 16.20 N
LONGITUDE	51 36.00 W
WATER DEPTH (M)	153
MOORING DATE/CRUISE	21/ 6/1980 80019
DURATION (DAYS)	123.7
SAMPLE INTERVAL (MINUTES)	60

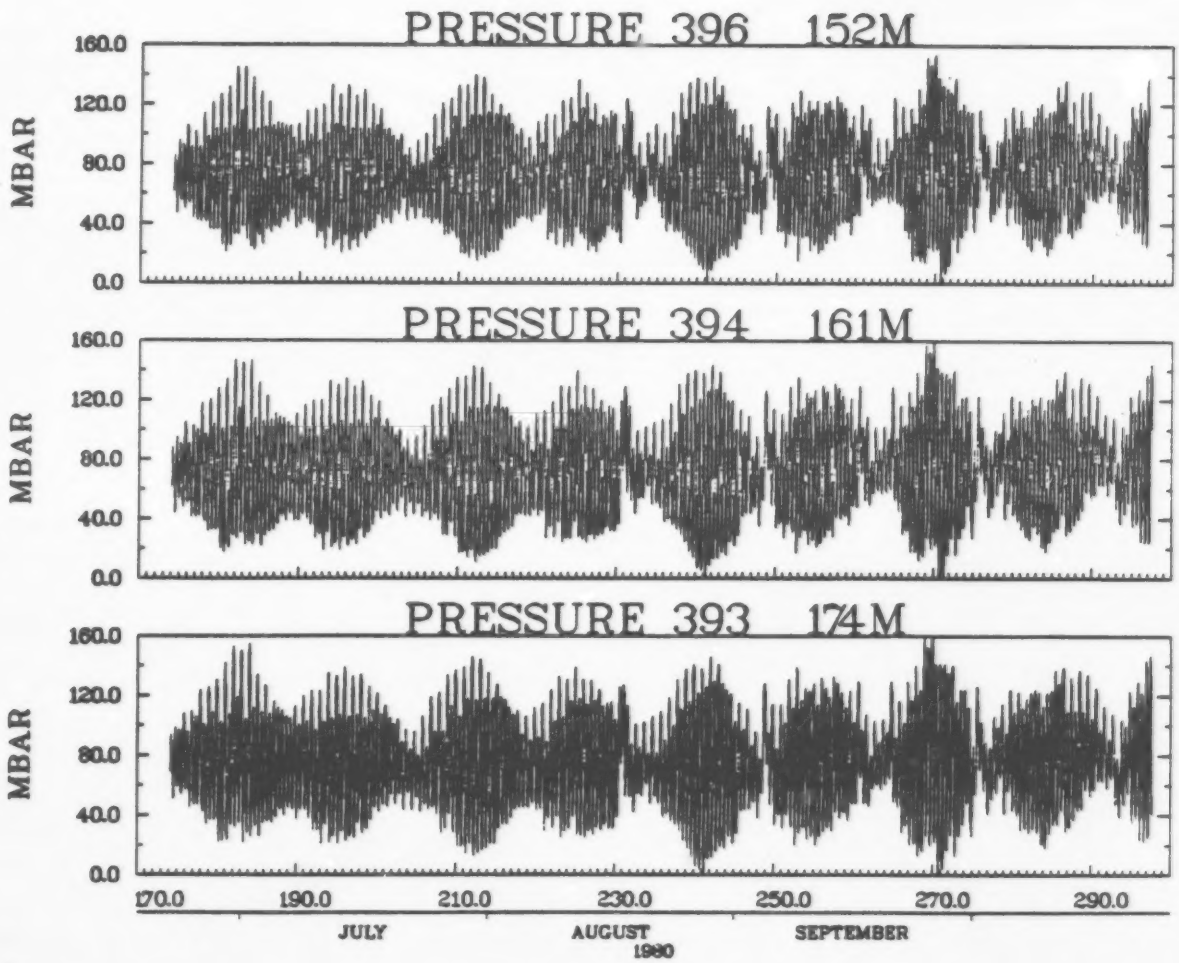
VARIABLE (UNITS)	MEAN	MIN	MAX	STD. DEV.	SAMPLES
PRESSURE (MBAR)	73.6	0.0	154.0	29.0	2951
TEMPERATURE (^{o}C)	-.04	-.57	.30	.14	2951

LOW PASS FILTER SAMPLE INTERVAL 6H

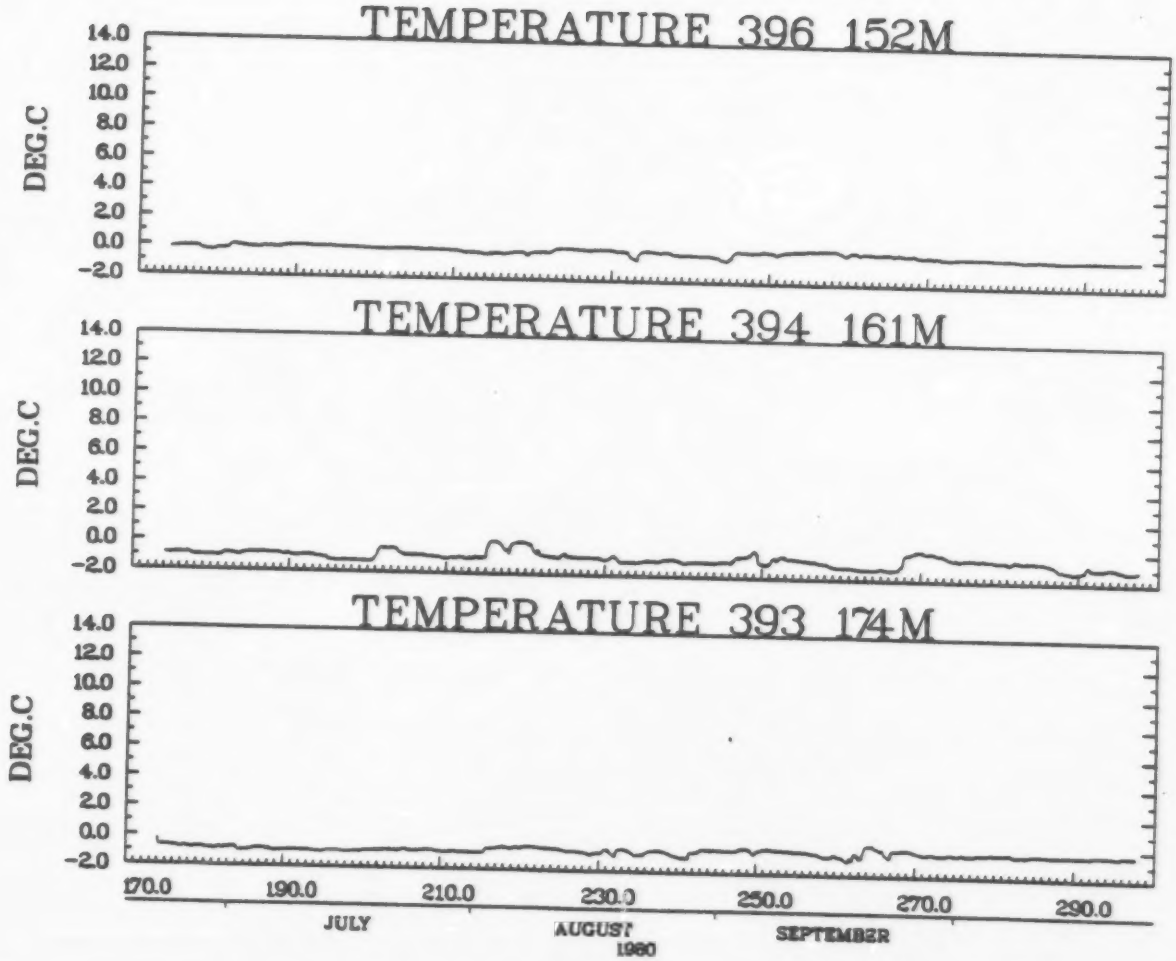
	PRESSURE	TEMPERATURE
MEAN	73.5	-.03
STD. DEV.	5.72	.14

COMMENTS

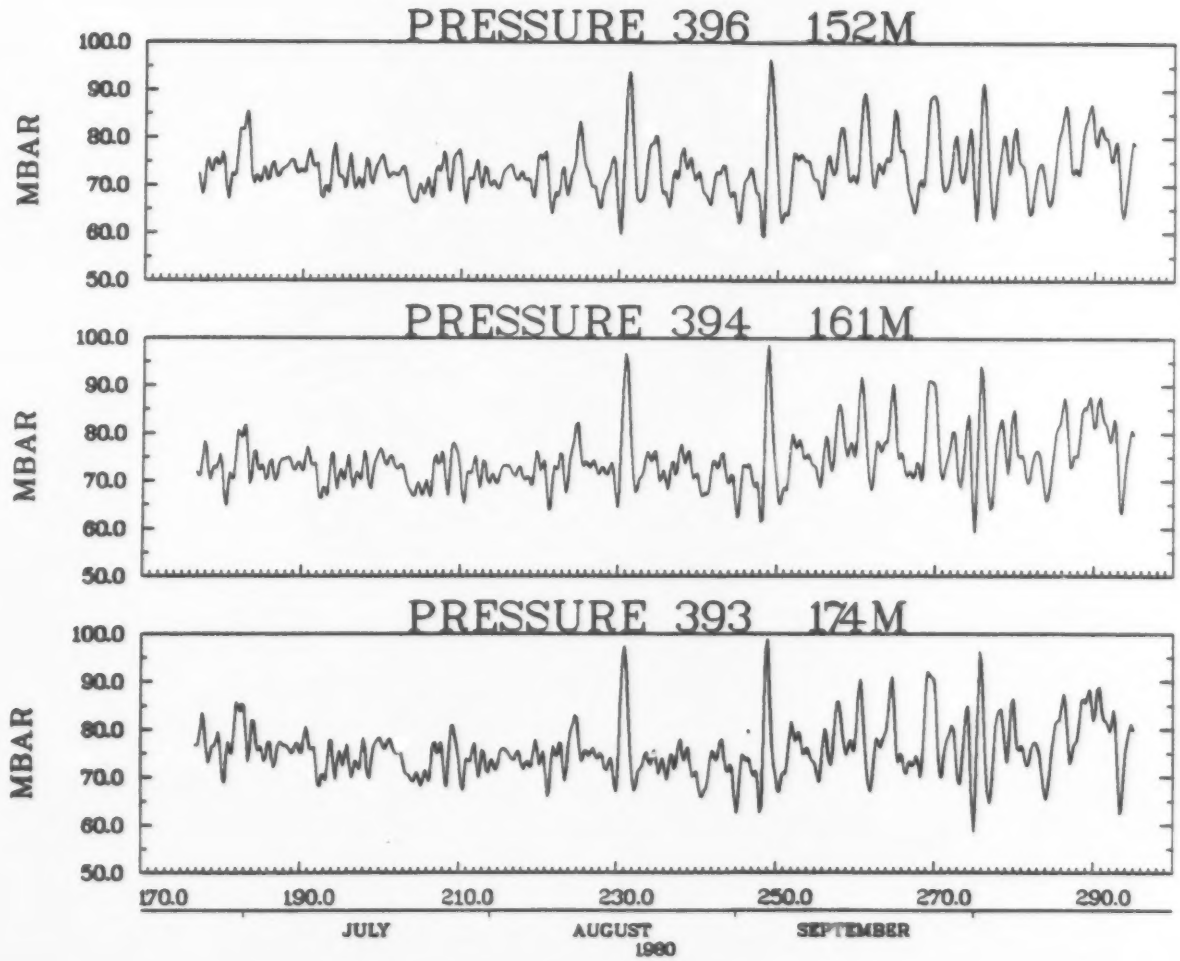
DATA WERE PROCESSED BY TIDAL SECTION SO THAT THE HIGHEST OBSERVED VALUE WAS SET EQUAL TO ZERO AND ALL OTHERS WERE CALCULATED AS (HIGHEST - OBSERVATION)



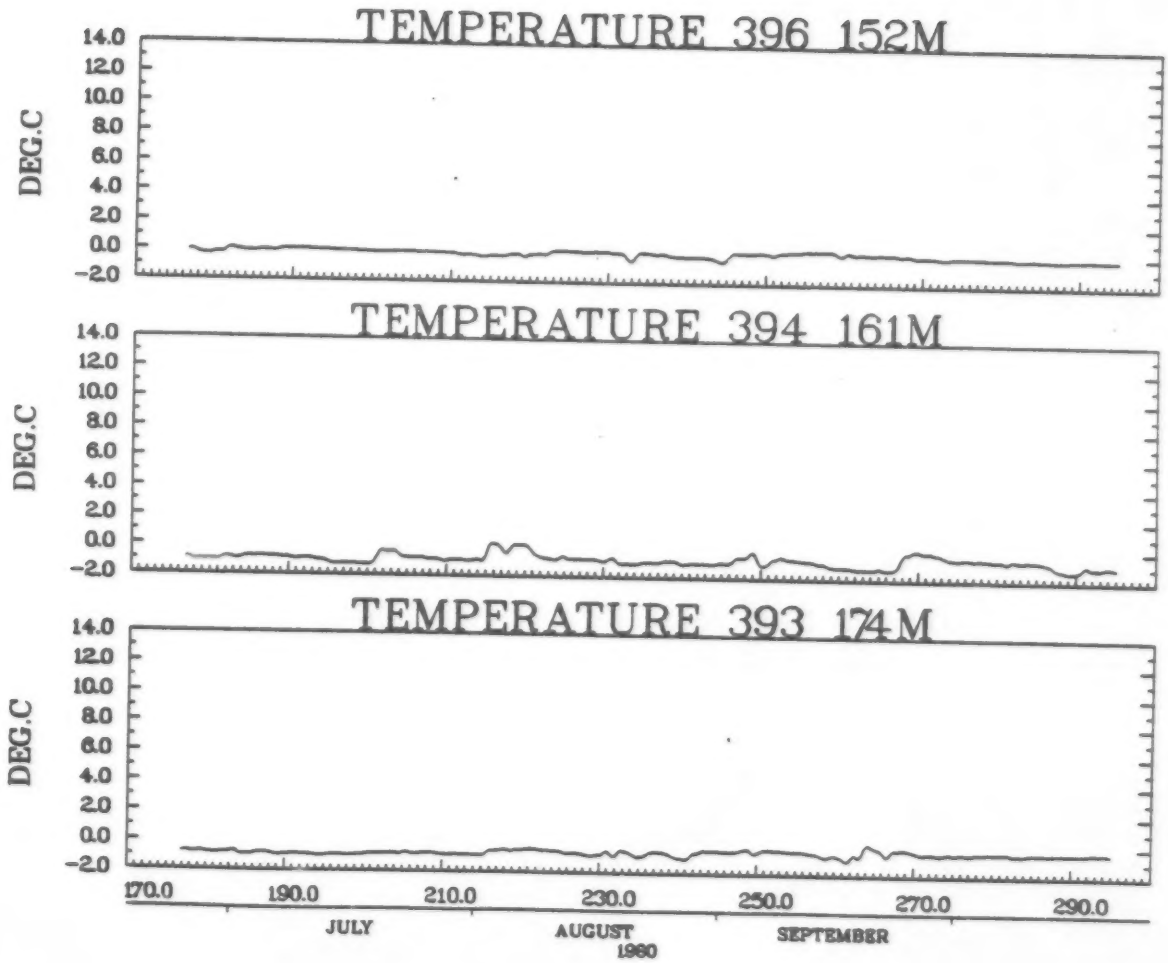
AVALON CHANNEL JUNE – OCTOBER 1980



AVALON CHANNEL JUNE - OCTOBER 1980

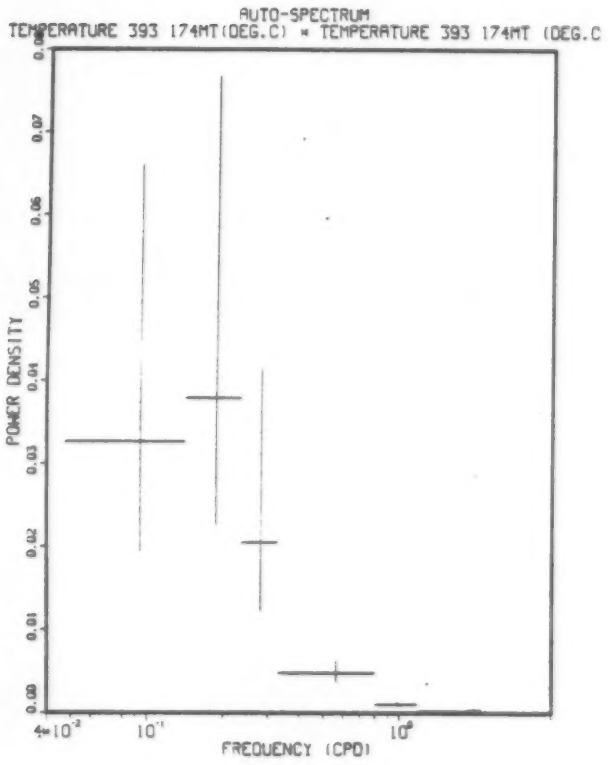


AVALON CHANNEL JUNE – OCTOBER 1980

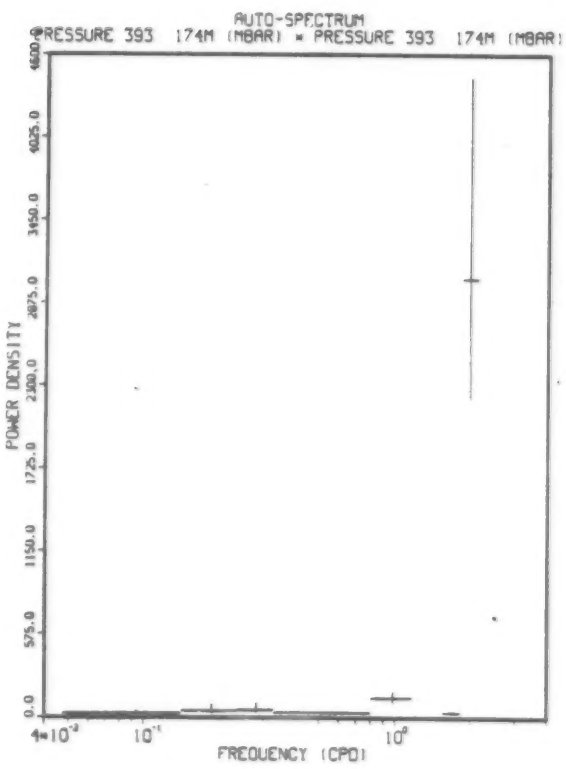


AVALON CHANNEL JUNE – OCTOBER 1980

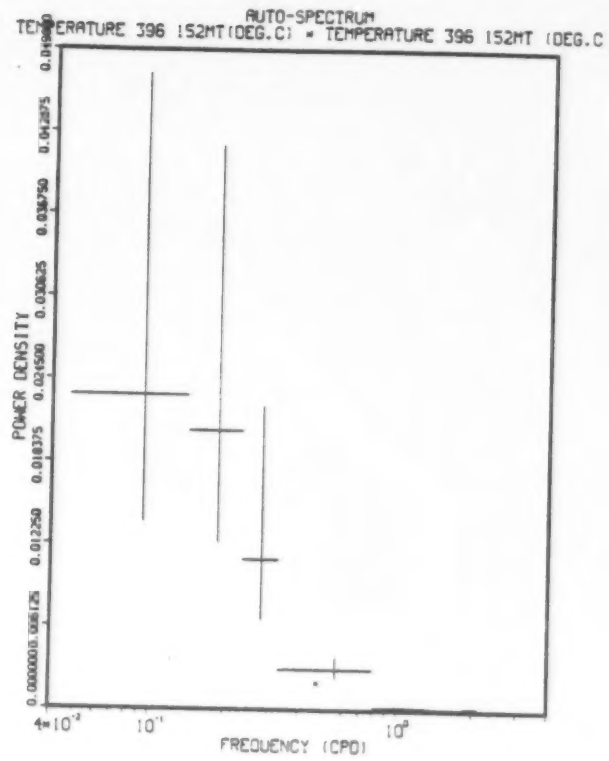
AVALON CHANNEL JUNE - OCTOBER 1980



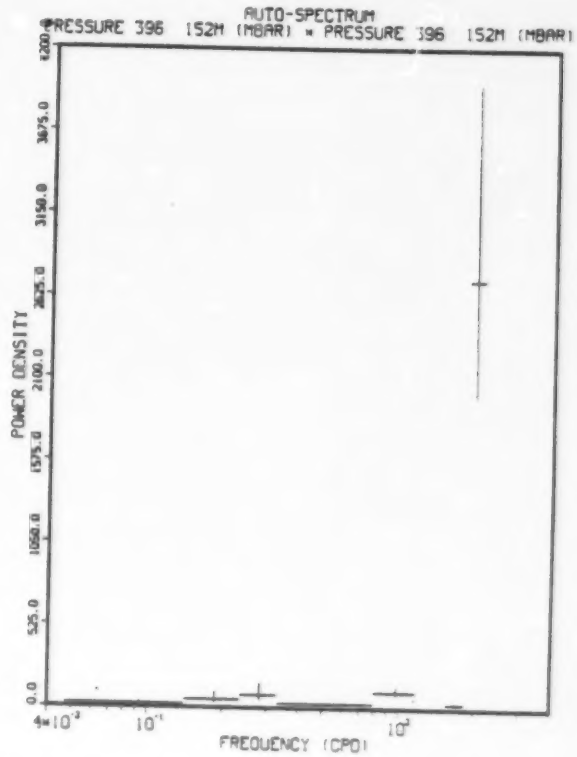
AVALON CHANNEL JUNE - OCTOBER 1980

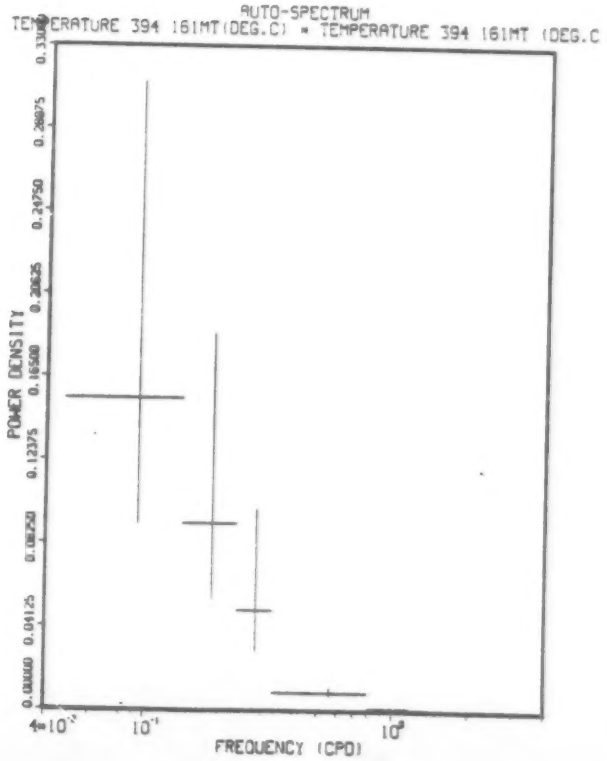


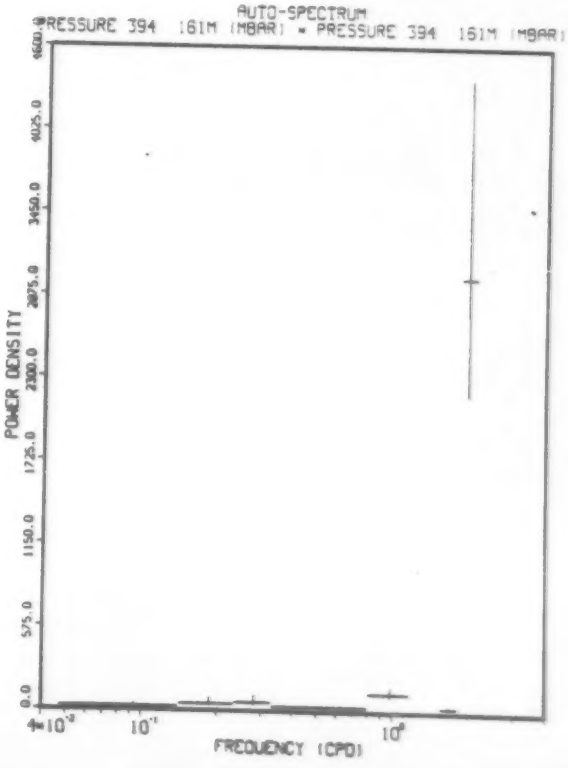
AVALON CHANNEL JUNE - OCTOBER 1980



AVALON CHANNEL JUNE - OCTOBER 1980







MOORING 429

DEPTH (M) 174

INSTRUMENT TYPE/SERIAL NUMBER	AANDERAA WLR5 372
LATITUDE	47 30.06 N
LONGITUDE	51 34.96 W
WATER DEPTH (M)	175
MORRING DATE/CRUISE	23/10/1980 80033
DURATION (DAYS)	181.8
SAMPLE INTERVAL (MINNUTES)	60

VARIABLE (UNITS)	MEAN	MIN	MAX	STD. DEV.	SAMPLES
PRESSURE (MBAR)	84.13	0.0	176.0	31.91	4363

LOW PASS FILTER SAMPLE INTERVAL 6H

PRESSURE

MEAN	84.02
STD. DEV.	9.00

COMMENTS

DATA WERE PROCESSED BY TIDAL SECTION SO THAT THE HIGHEST OBSERVED VALUE WAS SET EQUAL TO ZERO AND ALL OTHERS WERE CALCULATED AS (HIGHEST - OBSERVATION)

These two figures were generated by using the new OCEANS software analysis system. Some features of this software package, for example properly dated axes, which will make graphs more readable are still under development. However, the unfiltered (upper plot) and low pass data (lower plot) are presented below. Note that the start times of both series are shown in the lower left hand corners of the figures and that the time axes begin at that time. Increment of 10 days are are numbered and tick marks are displayed every day. A power spectrum of the pressure variations from this mooring is not shown because the suite of software to make the calculations is not available yet in the new system.